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# Forest Development Research

## PROGRAM

Manning Diversified Forest Products
Research Trust Fund
MDFP 21/95
Northwest Region Standing Committee for
For Caribou Project Update 1997/98

Alberta
ENVIRONMENTAL PROTECTION

- Disclaimer -

The study on which this report is based was funded by the Manning Diversified Forest Products Research Trust Fund (MDFP) which is a component of Alberta's Environmental Protection and Enhancement Fund (EPEF). The views, statements and conclusions expressed, and the recommendations made in this report are entirely those of the author(s) and should not be construed as the statements, conclusions, or opinions of members of the Manning Diversified Forest Products Research Trust Fund or of the Government of Alberta and its EPE Fund.

# Manning Diversified Forest Products Research Trust Fund

## MDFP 21/95

## Northwest Region Standing Committee for For Caribou Project Update 1997/98

December 1997

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# NORTH WEST REGION
# STANDING COMMITTEE FOR CARIBOU
# (NWRSCC)

# PROGRESS REPORT - 1997

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**DECEMBER 31, 1997**

# EXECUTIVE SUMMARY

This paper is a progress report of an ongoing biological study of woodland caribou in northwest Alberta. A radio telemetry program is being conducted, supported by extensive fieldwork. Habitat use, population dynamics, food utilization and environmental conditions are all being studied. Briefly listed are the trends and patterns observed over the past two and a half years of this study.

1. A total of 61 caribou were radio-collared during the 1994-95 and the 1995-96 winters. Twenty-one collared animals have died or the signal has been lost. Forty collars are still active, 24 in the Red Earth range and 16 in the Caribou Mountains range.

2. A database of telemetry locations has been developed, containing more than 5000 locations. These locations are primarily from Red Earth and the Caribou Mountains, with a few locations from the Pedigree range.

3. There have been no mortalities due to collaring procedures in this study. In northern Alberta, 200 animals have been collared since 1984, with only 1 mortality.

4. Visual sightings of collared animals during telemetry flights was quite high during the winter (80-90%) and low during the summer (20-40%). Growth of new vegetation and lack of snow cover all contributed to lower sightability of caribou during the summer months. There is also an effort made not to disturb females with young calves during the spring and summer.

5. Caribou herd sizes were larger in the winter than in the summer. The rut brought animals together in the fall and they remained in groups of 2-25 throughout the winter. Animals dispersed in the spring during calving and remained in groups of 1-4 throughout spring and summer.

6. Daily movement rates of collared caribou followed similar patterns in both study areas. Movements were greatest prior to calving, as animals dispersed. During late winter, as snow conditions became worse, animals became more sedentary.

7. Calf production was good both years in both study areas. The overall birth rate was 86%, which is considered average for the species. In 1997, calf production was low in both areas, averaging 80%.

8. Calving dates were relatively early, compared to other woodland caribou populations in Canada. Most calving occurred within the first 3 weeks of May, with some stretching into early June and some occurring in late April. Red Earth dates were roughly one week ahead of Caribou Mountain dates.

9. Cows showed some fidelity to calving areas. The second and third years of the study showed several females travelling long distances (up to 70km), to calve near locations they had calved the previous year.

10. Cows seemed to prefer open habitat for calving. A-B(low-med.) density black spruce stands and burns made up the majority of habitat cow-calf pairs were first observed in.

11. Collared caribou mortalities occurred throughout the year with 15 of 21 being suspected wolf predation. Mortalities did tend to occur more frequently during spring and summer.

12. Land and Forest Service (LFS) winter precipitation data indicates the last 3 years have been below average for winter precipitation in the Caribou Mountains. In Red Earth, the first year of the study was below average, while the last two years of the study were above average. It is important to continue studying caribou through a variety of winter conditions to accurately determine winter habitat use by woodland caribou.

13. Permanent snow transects monitored throughout the 1995-96 and 1996-97 winters indicated less snow accumulation in mature white spruce stands, aspen stands and on lakes, than in black spruce bogs, fens and open muskeg.

14. Microhistological analysis was done on caribou fecal pellets collected during the winter. Results indicated a similar diet throughout the winter, with a trend to slightly increased feeding on horsetail (*Equisetum*) in late winter and a slight decline in feeding on sedges during the same period. *Cladina/Cladonia* sp. made up over 70% of the winter diet.

15. Some species such as Labrador Tea seemed to occur more often in craters than its' presence in pellets would warrant. This is most likely a result of the association of Labrador tea with Bog/Fen habitats. It is a usual understory species in these habitat types.

16. Over 268km of caribou trail were followed in the past two winters. The results indicate high use of burns, cutlines, bogs, roads and aspen for travel. Feeding and bedding occurred almost exclusively in bogs, with some activity in open muskeg, fens, along cutlines and in burns.

17. Forest fires in the Caribou Mountains during the summer of 1995 appear to have had little short-term effect on woodland caribou. Collared animals using burned areas prior to the fire, continued using these areas after the fire, feeding and bedding in unburned residual patches within the fire boundary. One cow returned to the burned area to calve near where she had calved the year before the fire.

# INTRODUCTION

Industrial activity has been increasing over the last several years in northwest Alberta (Bloomfield and Sword 1981, Edmonds 1988, Hornbeck and Eccles 1991). In the Caribou Mountains, the south and east slopes are being logged for the stands of mature white spruce, while the Red Earth range is being fragmented by oil and gas exploration and development. The impacts of this industrial activity on the woodland caribou are not known. In an attempt to understand and reduce these impacts, standing committees were formed of government and industrial stakeholders. The goal of these committees was to develop operational guidelines for winter activities in sensitive caribou areas. These guidelines will be reviewed as understanding of caribou biology increases, in an attempt to balance resource needs with the sustainability of natural wildlife populations.

During the winter season of 1990-91, a study on woodland caribou in the Pedigree area was initiated by the Pedigree Caribou Standing Committee (PCSC). This study gave indications of the effects of natural gas exploration and development on caribou distribution and habitat selection, population dynamics, and of habitat conditions and selection by caribou in the Pedigree area (Hornbeck and Moyles 1995).

In the winter of 1994-95, the Northwest Region Standing Committee for Caribou (NWRSCC) initiated a study to gather baseline caribou data in the Caribou Mountains and Red Earth ranges. The study centered around a radio-tracking program. In conjunction with the radio-tracking program, extensive ground-tracking was also done.

It is important to point out at this time that the findings presented in this progress report are trends that have shown up in preliminary data analysis. Statistical analysis has not been done at this time, as the study has only covered two and a half winters. It is inappropriate to try and draw conclusive results from a study of this nature in so short a time frame. It is necessary to study the animals over a wide range of conditions (min. 3-4 years), as short-term studies give distorted views (Hatler 1986). Some statistical analysis will possibly begin in early 1998.

The habitat use/selection analysis will be based on comparison between habitat used and habitat available. This can not be done until complete Alberta Vegetation Inventory (AVI) mapping is done for both areas. This is currently underway, but will take several years to complete. When this information is available, analysis will be done using Geographical Information Systems (GIS's) and important caribou habitat will be mapped. This will allow land use managers to better plan activities in sensitive areas.

For these reasons, this report is more an empirical science than an extensive use of the scientific method (Thomas and Armbruster 1996). Emphasis will be placed on trends that become apparent throughout the time frame of the study. The extensive survey being carried out will also help to focus intensive studies on important factors, such as the predation/access issue. The project protocol will be reviewed after each field season to ensure that the data being collected is useable and relevant. The focus of the study remains as outlined in the Research Priorities report (EXCELeration Corp. 1994), unless other issues become apparent.

While the reader is cautioned that many of the findings presented in this report are only trend data, it is important to point out that most trends observed were consistent with the findings of numerous studies on caribou herds across the country. These studies will be referred to where appropriate. For trends that differ from other caribou populations, possible explanations will be given. These are only speculation and are not to be taken as fact.

## II. METHODS

### A. RADIO TELEMETRY PROGRAM

#### 1. Capture/Collaring

Collaring of caribou was carried out by Helicopter Wildlife Management. Normally, one helicopter was used to locate caribou and then members of the capture team moved in, in a second helicopter. A 5mx5m net was fired over the running animal, entangling it. The caribou was restrained with the use of leg straps and a blindfold. A very high frequency (VHF) radio collar (manufactured by Telonics, Mesa, Arizona or by Lotek, Newmarket, Ontario) in the 150-152 MHz range was attached around the neck of the animal. Blood samples and fecal pellets were collected and the sex, approximate age and general health of the animal were recorded. The entire process usually lasted less than 10 minutes.

#### 2. Telemetry Relocation

Each collar has its own unique frequency, allowing relocation of each animal separately. Animals were relocated on a regular basis using a small fixed-wing aircraft (Cessna 185 or 210), with a directional antennae mounted on each wing. A portable receiver unit was used to pinpoint the location of each animal, and the locations were determined using an onboard Global Positioning System (GPS). As each caribou was located, additional information was recorded on prepared telemetry data sheets. This information included herd size, an AVI description of the habitat, activity of the animals, as well as comments the observer may have (Fremmerlid pers. comm., Messier pers. comm., Moyles pers. comm., Seip 1992).

Relocation flights were flown once a week from Oct.-May, then once a month throughout the summer until the fall rut in Oct. For 1996-97, flights were twice a month from Oct.-Nov., once a week from Dec.-May and once a month through the summer.

This pattern will be continued in the future. The majority of telemetry flights were flown by Mark Fremmerlid (Slave Air, Wabasca, AB). Mark has several years' experience flying telemetry relocations on a variety of large mammals including caribou, moose and wolves. Mark flew much of the telemetry for the studies in northeastern Alberta, and is currently flying all telemetry flights for this study.

Flights were carried out at low level (300-500m above ground). This allowed for accurate recording of data and disturbs the animal minimally. Attempts were made to obtain visual sightings without disturbing the animals.

All telemetry data was entered into a database developed by the field researcher and the GIS department at Daishowa-Marubeni International (DMI), Peace River. It was developed using Microsoft Access, and is compatible with most GIS systems, to facilitate analysis.

One of the concerns associated with the analysis of telemetry data collected during this study is the accuracy of the animal locations obtained from the GPS unit onboard the aircraft. This concern initiated a study in which a series of test collars were placed randomly throughout the Red Earth caribou study range. The collars were then located in the same way normal telemetry locations are obtained. The locations of test collars were then compared to differentially corrected locations of the collars which were obtained using a handheld GPS unit and base station data from Whitecourt, Alberta. This allowed for the determination of the degree of accuracy of the collared caribou locations. The degree of accuracy will then be incorporated into analysis of telemetry locations to determine habitat selection and use by caribou in northwest Alberta. A copy of the report, including a more detailed description of the Materials and methods used, is attached in Appendix I.

To determine the degree of accuracy of differentially corrected data from the handheld unit, surveyed positions will be recorded using the handheld GPS unit and then differentially corrected. Comparing results with survey results will show the degree of accuracy of the handheld unit.

## B. MOVEMENT PATTERNS

Telemetry locations were mapped by DMI's GIS department. Maps of individual animal movements were made and individual animal movements were calculated and expressed as km/day. Results were graphed to see if there were any seasonal patterns and to determine patterns of movement. Home range calculations will also be done on this data in the future.

## C. SURVEYS

### 1. Fall/Winter

Calf surveys are being conducted in Nov. and March each year co-ordinated by Natural Resource Services (NRS), Peace River. The goal of these surveys is to determine yearly recruitment (calves surviving to 1 year of age) in both study areas. The surveys are carried out by helicopter, usually in conjunction with a fixed wing aircraft equipped with telemetry relocation gear, to increase the efficiency of locating animals. Collared animals are located and the position radioed back to the observation crew in the helicopter. Observers then recorded the total number of animals seen with a breakdown of sex, and age class of animals (adult or calf). Sexing of animals was done by the presence or absence of a black ring around the vulva, which is present on females (Bergrud and Elliot 1986). Calves were determined by their size and by close association to a cow. Herds spotted during surveys that were not associated with collared animals were also observed in the same manner. Attempts were made to view as many caribou as possible during these surveys to maintain an adequate sample size.

The results of these surveys provide information necessary to calculate population trends. When analyzed in conjunction with birth and mortality rates, it can be an indication that the population in question is growing, stable or declining.

### 2. Calving

During May, when calving occurs, increased effort was made to obtain a visual sighting of collared cows. The first time a cow was seen with a new calf, it was recorded. If cows were not seen with a calf by early June, it was assumed they were either not pregnant or had calved and lost their calf before we could observe it. In either case, it was treated as a barren cow. This gave us a minimum pregnancy rate for the collared cows. These results were used in understanding birth rates and in determining population health.

## D. MORTALITIES

The radio collars deployed for the study are equipped with two signals, a regular signal and a mortality signal. In the event a collar sits motionless for a 24-hour period (ie. slipped collar or mortality), the signal rate increases noticeably to alert the observer.

When a mortality signal was encountered during a telemetry relocation flight, an investigation into the cause of death was initiated as soon as possible. The local NRS officer was notified and requested to accompany the field researcher to the site. Ground access was used when possible, otherwise a helicopter was chartered. The site was located on the ground using a portable receiver and a hand held directional antennae. At the site, the carcass and surrounding area were examined for tracks, blood, scats or signs of a struggle to determine the cause of death(Edmonds 1988, Moyles pers. comm.). The collar was recovered for re-deployment. If possible, jawbone, legbone, fecal pellets and flesh samples were collected for analysis. Mortality information is useful in determining possible limiting factors (Klein 1991, Messier 1995, Schaeffer and Messier 1991) on caribou populations in both ranges.

## E. HABITAT USE

### 1. Telemetry Observations

During telemetry flights (methods already discussed), habitat the caribou were observed in was recorded following AVI specifications. The activity animals were engaged in was also recorded. This data will be used to support the results from the GIS analysis on habitat use and selection.

### 2. Field Observations

Groundwork was conducted during the late fall, winter and early spring seasons, once areas were accessible (after freeze-up). Seismic lines and trails were travelled by snowmobile until a set of relatively fresh caribou tracks was found. The trail was then backtracked. Backtracking, rather than following was done so as not to disturb the animals, causing them to move into habitat they might otherwise not be using. Location of caribou 'trails' travelled were recorded using a handheld GPS unit (Trimble Geo-Explorer) to record locations. Total distances travelled through each habitat were recorded, as well as different activities such as feeding and bedding. This information will be used to support telemetry findings on habitat use.

In feeding areas, the contents of feeding craters were identified and species present were recorded. A total count of craters in the feeding complex was made and snow depth measurements at craters were recorded. Feeding complex locations were determined by GPS, differentially corrected, and entered into a database.

In bedding areas, the number of beds in each habitat was recorded, along with snow depth measurements at each bed.

### 3. Fecal Pellet Analysis

Caribou fecal pellets were collected throughout the winter and early spring as long as there was snow cover. Collected pellets were grouped according to season (early winter, late winter and spring). They were further grouped according to study area, and in the Caribou Mountains were grouped by location (top or slope).

Pellet samples were bagged separately in the field, then later air-dried with salt (Foppe pers. comm.). Composite samples were then put together and shipped to the Composition Laboratory in Colorado for microhistological analysis. Five slides for each of 3 reps per composite sample were examined (Adamczewski et al. 1988, Thomas and Barry 1991, Thomas et al. 1994). Plant species were identified to the genus level (species level when possible) and their percentage composition calculated.

## F. CLIMATIC CONDITIONS

### 1. Weather Stations

In the fall of 1995, 2 weather stations were established within caribou range in the Caribou Mountains. One station was constructed on top of the plateau, the other on the south slope on the road to Foggy Tower. These stations take hourly measurements of snowfall, temperature, wind speed and direction, relative humidity and solar radiation. Information is stored on dataloggers at the stations and is downloaded monthly throughout the winter. R.H. Swanson & Associates, Canmore, Alberta processed all weather data and it was entered into an Access database for analysis.

A snow depth sensor was purchased in the fall of 1996, and was added to an existing weather station in the Red Earth study area. This station was established as part of an Daishowa-Marubeni International Limited Silviculture Research Project. Previous to this, weather data was purchased from Environment Canada for the Red Earth area.

### 2. Snow Measurements

Snow transects were conducted in both study areas through the 1995-96 and 1996-97 winter. Snow depth, hardness and profile were measured once a month at permanent plots in a range of habitat types (Edmonds and Bloomfield 1982, Hervieux pers. comm., Rettie pers. comm.) Habitats included: white spruce, A B and C density black spruce bogs and fens, aspen, pine, lakes, burns, open muskeg, open grass, lease sites and cutblocks. Two transects were set up in each habitat type, in each area. In the Caribou Mountains, transects were established on top and on the slope.

Snow measurements were taken once a month. A line transect was set up starting at a central point in the habitat. Ten measurements were taken, 1 every 5m along the line. Each month a new line transect was established with a different random heading from the same central point.

Snow conditions were very tough during the end of March and first part of April in 1997. Because of this, an extra set of transects was done. This will provide important data during this critical time for the caribou.

## III. RESULTS AND DISCUSSION

### A. RADIO TELEMETRY PROGRAM

#### 1. Capture/Collaring

When the project began, a strategy was developed to study caribou in previously un-researched ranges which represented a variety of habitat types. Caribou ranges in the province cover a variety of different natural regions (Fig. 1). In an effort to have representation in all regions, it was decided to collar animals in the Red Earth and the Caribou Mountain ranges. A radio-collaring program has already been carried out in the Pedigree range. This provided coverage of most of the Natural Regions in northwest Alberta, and habitat information can then be extrapolated to similar habitats.

In December 1994, 20 woodland caribou were collared in the Caribou Mountains. In January 1995, 23 were collared in Red Earth. In the winter of 1995-96, 5 additional animals were collared in the Caribou Mountains to replace mortalities. In Red Earth, 3 collars were added to replace mortalities, and 10 additional collars were added to boost the sample size to support the NWRSCC/NERSC access research project.

Animals were netted rather than drugged during collaring procedures. All animals collared to date in this study have survived for at least one month following capture, which is the time frame in which delayed mortality effects associated with capture myopathy would be expected. Also, of 37 possibly mature cows that were collared in our study, 32(86%) calved the spring following their capture. The average birth rate for the species is considered to be 86% (Bergrud and Elliot 1986). Since 1984, 200 caribou have been collared this way in northern Alberta, with only 1 mortality attributed to this procedure.

Figure 2 shows the breakdown between sexes of collared caribou in both study areas. In both areas emphasis was put on collaring females. Birth rates and calf survival are important components of population dynamics, and this information is obtained by following females throughout the year. It was felt that some males should be collared though, in the event that habitat use, movement patterns, and time of year/causes of mortalities differed between males and females.

## 2. Telemetry Relocations

Active collars include 16 females and 13 males (29 total) in Red Earth, and 16 females and 3 males (19 total) in the Caribou Mountains. Telemetry flights are being flown twice a month from Oct.-Jan. From Jan.-May flights will be once a week, and from June-Sept., once a month.
All telemetry data is stored in an Access database. Over 3200 separate entries have been made from Red Earth, Caribou Mountains and Pedigree ranges. This data forms the core of the study.

Throughout the year, sightability of the collared animals varies. Figure 3 illustrates lower percentage of visuals obtained during the summer months (20-40%). The light coat colour of caribou, combined with dense, new vegetation growth and lack of snow cover all contribute to the lower sightability. During the winter, with snow as a backdrop and the coats of caribou turning darker, they become easier to spot during telemetry flights. The only time of year when serious efforts were made to get visuals of collared animals was during calving. This explains the increase in sightability in May over the rest of the snow-free period.

Group size was averaged out for each telemetry flight, for each area. Figure 4 shows the average group size pattern throughout the year for Red Earth and Caribou Mountains. The rut in the fall brought animals together, and they stayed grouped (2-25: average 6) during the winter. In spring, animals dispersed in preparation for calving in May. They stayed in small groups (1-4: average 2), many of which were cow-calf pairs, until the fall. This pattern is consistent with other studies (Edmonds 1988, Stuart-Smith et al. 1995). Dispersion in the spring prior to calving is suggested by many to be a predator avoidance tactic (Brown and Theberge 1990, Edmonds and Smith 1991). By spreading out, they lessen the chance of encountering predators (Bergrud et al. 1990, Seip 1991). This plays an important role in calf survival.

Average herd size was consistently larger in the Caribou Mountains than in Red Earth, as was the maximum group size. The reason for this is unknown. One speculation though, is that it could possibly be a reflection of population health. The relationship between average herd size and population health will be looked at when the study has covered several years. If herd size is found to correlate with the health of caribou populations, it would be a useful means of assessing population health.

Preliminary accuracy checks on the GPS units indicate that the Apollo IImorrow GPS unit in Slave Air's plane, with Mark flying was the most accurate. The range of accuracy was from 75m to 292m, with an average of 163m. A High Level company, Northern Sky Aviation, flew 10 telemetry flights using a Loran navigational system. The range of accuracy it displayed was between 223m to 1323m, with an average of 530m. When Northern Sky flew with an Apollo IImorrow GPS, the range was 112m to 336m, with an average of 223m. The Apollo IImorrow GPS unit was the most accurate, and the best results were obtained when Mark Fremmerlid was the pilot. The many years of telemetry experience Mark has, increase the accuracy of locations recorded during the flights he flies.

Check collars and check positions will be utilized throughout the time period of the study. Checks will be done in all seasons to account for any differences in accuracy that may be a result of general climatic conditions.

## B. MOVEMENT PATTERNS

Individual movement patterns of several females and males were mapped for each area. Straight-line distances travelled between relocation points were determined, then divided by the number of days since the last flight for a daily rate of movement (km/day). When plotted over time, a distinct pattern was observed. Figure 5 shows the minimum amount of movement by collared females #9608(a relatively mobile animal) and #9604(a relatively sedentary animal). Animals were somewhat mobile in the fall and throughout early winter. As snow depths increased in late winter, animals became more sedentary. In April, in preparation for calving, cows made large movements as they dispersed. After calving, there was little movement, and this trend continued throughout the summer. High movement rates in winter and low rates in summer is consistent with other studies on woodland caribou populations in western Canada (Fuller and Keith 1981, Shoesmith and Storey 1977, Stuart-Smith et al. 1995). Male movement rates that were analyzed indicate a similar pattern.

Movement rates were possibly underestimated during the summer months. Telemetry flights were only flown once a month during this time and therefore daily movement rates are less accurate.

Figure 6, shows movements of animal #9517 (Caribou Mountains) in relation to snow depth taken from permanent transects. As snow reached depths of 50cm or more in late winter, the animals moved around very little.

Similar to other studies, there was no migratory pattern observed for these two populations of woodland caribou (Edmonds 1988, Fuller and Keith 1981, Stuart-Smith et al. 1995). The only predictable movement is the dispersion prior to calving. This dispersion is random amongst individuals, covering a variety of habitats. There is no common calving ground in either study area.

Home range sizes have not yet been calculated. Further analysis will be done with this data in the future, as more data is gathered.

## C. SURVEYS

### 1. Fall/Winter

The majority of calf mortalities generally occur within the first few months after birth (Bergrud 1978, Fuller and Keith 1981, Stuart-Smith et al. 1995). If a calf survives a full year, then it is considered to have been recruited into the population (Edmonds and Goski 1982, Gray 1977). Population counts were made during the fall and winter calf survey flights in an attempt to determine recruitment rates. In both areas, recruitment rates seemed to be low. Complete analysis of recruitment data has not yet been completed.

The number of calves seen increased in the March 1996 survey as compared to the March 1995 survey. In 1995, cow:calf ratios were 9:100 and 10:100 for Red Earth and Caribou Mountains respectively. In 1996 the ratios were 23:100 and 16:100 respectively. Mortality rates and bull:cow ratios must still be determined, so that the percentage of the population that is made up by calves can be determined. This figure can be used to determine population health (Bergrud 1974).

### 2. Calving

Calving occurred during the month of May, with most calves born within the first two weeks. Figures 7 and 8 show calving dates for the spring of 1995 and 1996 in both ranges. These calving dates are the first sighting of a cow and new calf. The actual calving date may be up to a week earlier due to the weekly nature of telemetry flights. Calving dates in both areas are earlier than in other caribou populations in Canada (Brown and Theberge 1990, Edmonds 1988, Edmonds and Smith 1991, Hatler 1986). The Red Earth range was roughly 1 week earlier than Caribou Mountains both years.

Calving dates were spread out more in 1996 (Fig. 7 & 8). In 1995, all calves were seen in a two-week spread in the first two weeks in May. In 1996, calving started in the last week of April and continued through to the first week in June. Reasons for the spread are unknown, however the dates for calving are dependent on the rutting dates.

The number of calves produced each year was high in both areas. The overall average birth rate for the two years of the study was 87%. This is slightly higher than Bergrud's (1974) average of 86% for woodland caribou populations in Canada. The high calf production and low calf survival in March surveys indicate high calf mortality. The causes of mortality amongst calves were not investigated in this study. In other studies, predation is believed to be the main limiting factor in calf survival (Bergrud 1978, Edmonds and Smith 1991, Heard and Boutin 1982, Miller and Broughton 1972).

Woodland caribou often show fidelity to calving sites (Brown and Theberge 1990, Edmonds and Smith 1991, Hatler 1986, Heard and Stenhouse 1992, Hornbeck and

Moyles 1995). In this study, many of the collared cows showed fidelity to previous calving sites. Figures 9 and 10 show calving sites of collared animals. All females that were observed with a new calf both years have been circled. Although the scale of the maps is quite large, there is a considerable degree of fidelity to calving areas. In the Caribou Mountains, both #9501 and #9514 travelled well away from their usual range (over 70 km movements were observed) to calve near where they had calved the previous year. Cows in the Red Earth range all seem to show higher fidelity than cows in the Caribou Mountains. This could be a result of higher fragmentation of habitat, with less suitable habitat for calving. The degree of fidelity will be quantified when home range size calculations are completed.

## D. MORTALITIES

Sixteen collared animals have been lost since the study began. Figure 11 shows a breakdown of these mortalities. Probable wolf predation accounts for 12 of the collared animal deaths. These kills were attributed to wolves after investigation of the mortality site and having field researchers and AFWS officers agree on probable cause.

In Red Earth, the only other mortality was a lost signal. It is not known why the signal was lost. There was a strong signal the previous telemetry flight, shortly after the animal had crossed a main road. The following week, the signal could not be picked up. A collar malfunction is possible. Another explanation could be that the animal was shot and the collar destroyed. The North-East Region Standing Committee (NERSC) attributed similar signal loss to human caused mortality.

In the Caribou Mountains, one animal was lost to natural causes other than predation. It was an apparently healthy adult bull, and evidence leads us to believe a rutting injury may have been the cause of death. The other mortality was a probable human kill. Evidence at the site, as well as 'coffee shop talk' overheard by the field researcher and a Fort Vermillion AFWS officer on separate occasions led to this conclusion.

Wolves are often cited as the major predator on caribou populations in many areas (Edmonds 1988, Hearn et al. 1990. Seip 1992, Stuart-Smith et al. 1995). Over 75% of the mortalities in this study were attributed to wolves. Figure 12 shows the number of collared caribou killed by wolves by month. This figure includes 10 kills from this study plus 4 from the Pedigree study. Most of the predation occurred in the spring and summer. Constant movement by animals is thought to reduce contact with predators. The higher rate of predation in summer may be related to the low rates of movement observed during the same time period. The animals may be easier to find when they are sedentary.

## E. HABITAT USE

### 1. Telemetry Observations

During calving periods, cows were usually observed in open habitats. The majority of cow-calf pairs were first observed in A-B density black spruce stands. Old and new burns, and open muskeg were also used (Fig. 13). Open habitat gives the animals a clear field of view to watch for predators. Also, the habitats used allow for some degree of spatial separation from moose, the main source of prey for wolves (Seip 1992, Stuart-Smith et al. 1995). In these open areas, there is plenty of new vegetation in May and June. This provides ample food for the cows without having to move much while they nurse calves.

### 2. Field Observations

During backtracking in the winter of 1995-96, over 100km of caribou trails were followed on foot. In the Caribou Mountains, animals were found to be travelling through B density bogs and burns most frequently (Fig. 14). Cutlines, as well as A and C density bogs were also used. The use of cutlines may be slightly over-represented because all trails that were backtracked started on a cutline. Comparing habitat travelled through and where feeding and bedding occurred (Fig. 15), black spruce habitat seems to be important to woodland caribou in the Caribou Mountains. Pellet data results supported the theory that *Cladina* sp.( lichen) are an important winter food source for caribou (Adamczewski et al. 1988, Harris 1992, Helle et al. 1990, Holleman and Luick 1977, Thomas and Barry 1991, Thomas et al. 1994). These lichen are most abundant in black spruce bogs, particularly in low density bogs with an open canopy (De Vries pers. comm.). The use of white spruce habitat was very minimal, and was usually travelled through to reach bog areas.

Similar patterns of habitat use were observed in Red Earth. There was no use of burns though (Fig. 16), due to the very small amount of habitat that has burned in the last 10-20 years. In the Caribou Mountains, over half the habitat has been burned in approximately the last 20 years. The other difference was a high amount of travel in aspen stands. Figure 17 shows much the same habitat use for feeding and bedding as in the Caribou Mountains. Aspen was not used at all for either activity. The large amount of travel through aspen, is probably a result of the fragmented habitat in the area. As well, snow depths were lower in aspen than in bogs.

### 3. Fecal Pellet Analysis

Winter diet of the woodland caribou in the Caribou Mountains was determined by microhistological analysis of fecal pellets collected during fieldwork. This technique is thought to give an accurate assessment of diet (Thomas and Barry 1991, Thomas and Kroeger 1981, Thomas et al. 1984). The results from the 1994-95 winter are in Figure

18. As expected, *Cladina/Cladonia* species made up the bulk of the winter diet (Adamczewski et al. 1988, Harris 1992, Helle et al. 1990, Holleman and Luick 1977, Thomas et al. 1994). The Composition Laboratory staff were unable to differentiate between the two genuses, but felt the majority was *Cladina* sp. (Foppe pers. comm.). Observations made in feeding craters also support this. This high use of lichen in the winter diet was supported by backtracking data as well. *Cladina* sp. were present in over 80% of the craters studied (Fig. 20).

Two shifts in winter diet that were observed were an increase in consumption of horsetails (*Equisetum* sp.) in late winter, and a decrease in the consumption of sedges (*Carex* sp.) in the same time period. These shifts involve small percentages of the diet, but still may be important. Horsetails may provide animals with necessary nutrients in the late part of winter. Sedges may be important in early winter diet when they are easily available. During early winter telemetry flights and the fall calf survey, caribou were often seen feeding around the edge of wet, open areas, where sedges grow. In the late winter, few observations of this kind were made. The drop in feeding on sedges may be a result of deeper snow in the open areas in late winter. As the winter progresses, snow becomes wind-packed and drifted in along the edge of open areas.

Some species show up often in feeding craters, but make up a very small part of the diet. Labrador tea (*Ledum groenlandicum*) shows up in 80+% of craters, yet accounts for less than 5% of pellet composition. This is probably because it is usually associated with *Cladina* sp. in black spruce habitat. It is not a major winter food source though for woodland caribou in either of the two study areas.

Bog cranberry (*Vaccinium oxycoccus*) and bog birch (*Betula glandulosa*) also showed up in craters (10-15%), yet did not appear in pellet samples. They are also often associated with Labrador tea and *Cladina* sp. Another possible explanation for species being present in craters often, yet showing up very little in pellets is that some species may be present in craters in very small amounts. When looking in craters, presence was noted, there was no determination of abundance. For example, *Cetraria* sp. were seen in approximately half of the craters (Fig.19) and yet made up a small portion of the pellets (Fig.18). *Cetraria* sp. were almost always associated with *Cladina* sp. but only represented a small percentage of the ground cover.

## 4. Forest Fires

During the 1980's, large portions of the Caribou Mounains burned, particularly in the southwest quarter. In 1995, a large (132,000ha) fire burned most of the southern part of the Caribou Mountains. There has been a lot of speculation on the effects of these burns on the woodland caribou in this area. During the 1995 fire, collared animals were monitored when it was safe to do so. The results indicate little short-term effect on general distribution of caribou, and no collared animals were lost in the fire. Most collared caribou in the areas that burned moved out, but moved back as soon as the fire was out in that area. One cow that had calved in the burned area just prior to the fire, was back in the same area within the fire boundary, to calve the following spring.

It is important to clarify that the burned area is not completely burned. Some parts of the burn are quite patchy, with many residual patches of forest. In many cases, it is these patches that are used by the caribou. When back-tracking caribou through the burn, trails went from one residual patch to the next, where animals fed and slept.

The long-term effects of the fires are not fully understood. Schaeffer and Pruitt Jr. (1991) suggest that after 5-10 years, animals begin to abandon burned areas. This is suggested to be a result of an increase in the amount of deadfall making travel difficult, or a decrease in the amount of lichen available. In much of the burned areas on top of the Caribou Mountains, there are low densities of trees. Most of the trees present are short (4-10m), and when they do topple, are not a big obstacle. Burns from the 1980's and earlier have apparently not been abandoned, animals have been observed in them throughout the year. Further analysis will be done on telemetry locations relative to old burns.

In some newly burned areas, the fire swept over quickly, leaving a lot of lichens and mosses. Effects of the fire should be monitored over time to see if these patches of lichen and moss eventually die off or regenerate in the burned areas, and how long regeneration takes. Cloudberry (*Rubus chamaemorus*) was already growing back in burned areas only a month after the fire.

The long-term effects on permafrost in the area need to be studied. Permafrost creates dry sites in muskeg bogs, where lichen grow (Bradshaw et al. 1995, DeVries pers. comm.). If the permafrost melts, these areas may become too wet to support lichen growth.

## F. CLIMATIC CONDITIONS

### 1. Weather Stations

Historic weather data for the two study areas was obtained from the Land and Forest Service (LFS). The average winter precipitation (mm) was taken from two weather towers in each range for the last 10 years. Total precipitation measures the water equivalent, it does not indicate snow depth or condition. This data was analysed to get an idea of how precipitation in the two winters of the study compare to the 10 year average. Figure 20 shows that the last two years have had substantially lower than average winter precipitation in the Caribou Mountains. In Red Earth (Fig. 21), there has been less yearly fluctuation in winter precipitation. The winter of 94/95 was the 10-year low for winter precipitation, while 95/96 was the 10-year high.
The wide range of winter conditions indicated by these two graphs, show the importance of long term studies. Short term biological studies or impact assessments can have biased results.

Winter data from the two new weather stations established in the Caribou Mountains was not compiled soon enough to be integrated into this report. Habitat use and animal movement will be analyzed with regards to weather in the future, in an attempt to understand the effects of climatic conditions on woodland caribou.

### 2. Snow Measurements

Permanent snow transects were set up in a variety of habitat types, and were monitored regularly throughout the 1995-96 winter. Snow depths were consistently lower in mature white spruce and aspen habitats, as well as on lakes. This is a result of higher snow intercept by the larger trees, and thicker crown closure in mature white spruce and aspen stands. On the lakes, wind blew much of the snow off into surrounding habitat.

Snow conditions are thought to be an important factor in habitat use for caribou (Adamczewski et al. 1988, Brown and Theberge 1990, Eastland et al. 1989). There may be some effects when snow depths become quite high (>60cm), as in the decrease in movement rates previously discussed. In general though, snow conditions during the 1995-96 winter did not seem to affect habitat use. There were no shifts in habitat that were noticeable. Figure 22 shows snow depths related to habitat use in B-density bogs in Red Earth (results are typical of results in most other habitats). Snow depth at feeding and bedding areas, and along travel routes are similar to depths measured in permanent transects. This suggests that animals are not selecting areas with less snow within habitats. Snow depths observed in the first years of this study, seem to have had little effect on the caribou, other than movement rates declining as snow depths topped 50 cm.

## IV. CONCLUSION

This study was recommended as a minimum 4-year project. The reason for the 4-year minimum is so that woodland caribou can be studied under a wide variety of winter conditions. As mentioned in the introduction, this study will allow for determination of other factors that may need to be studied as well. Future projects to be carried out in northern Alberta include: an analysis of peatland types and permafrost; assessment of habitat use relative to the past fires; and an assessment of elevation selection by woodland caribou. Also, a project is currently being initiated on the amount of and effects of access in caribou ranges. This study will compare the Red Earth and the Wabasca caribou ranges.

Further analysis on home range sizes, calving site fidelity and habitat use/availability still has to be completed on data collected to-date. Much of this is dependent on AVI mapping that is currently underway in both study areas.

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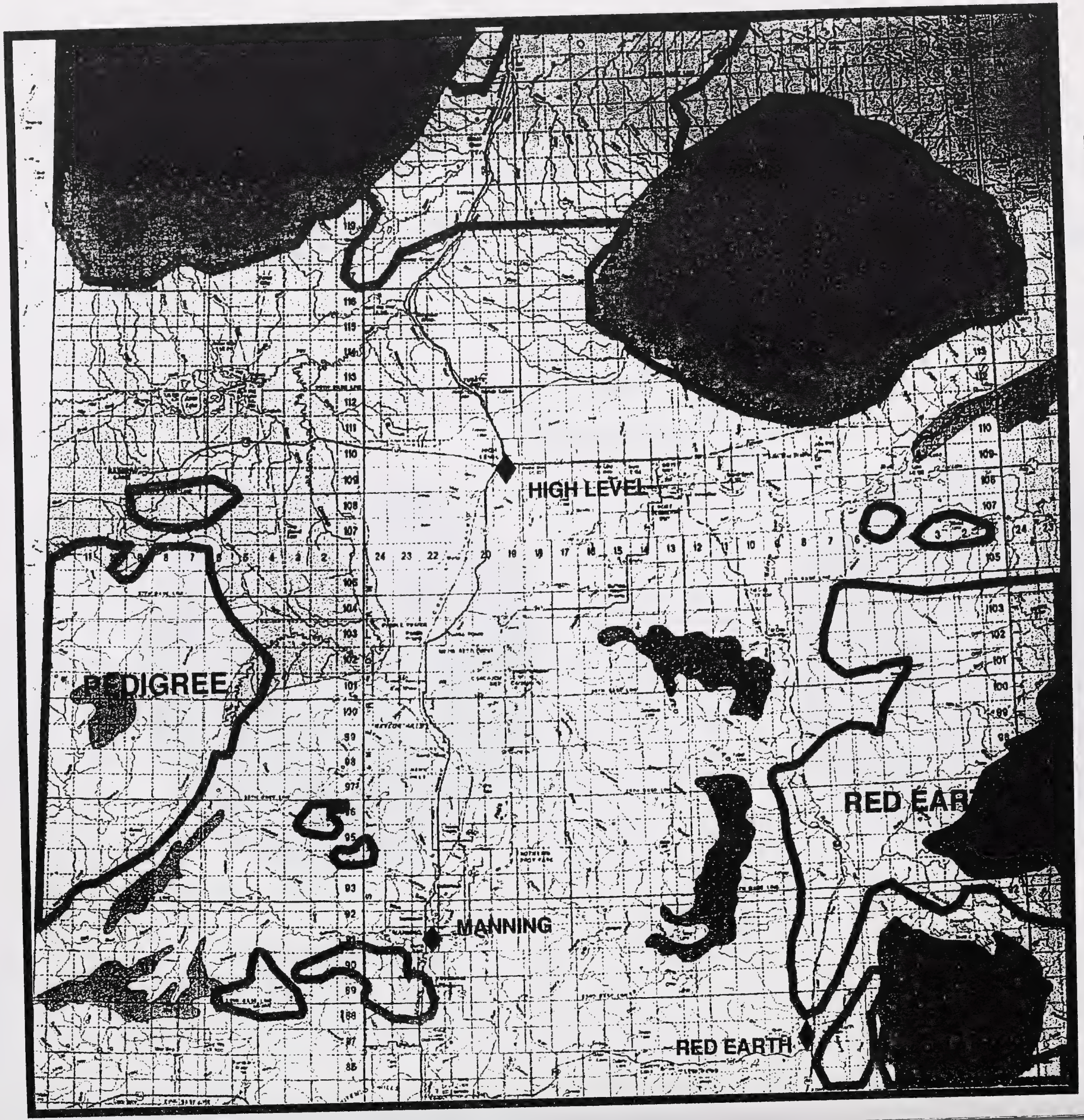

*FIGURE 1*

*NOVEMBER 1997*

# RADIO COLLARS
## Caribou Mtn. and Red Earth

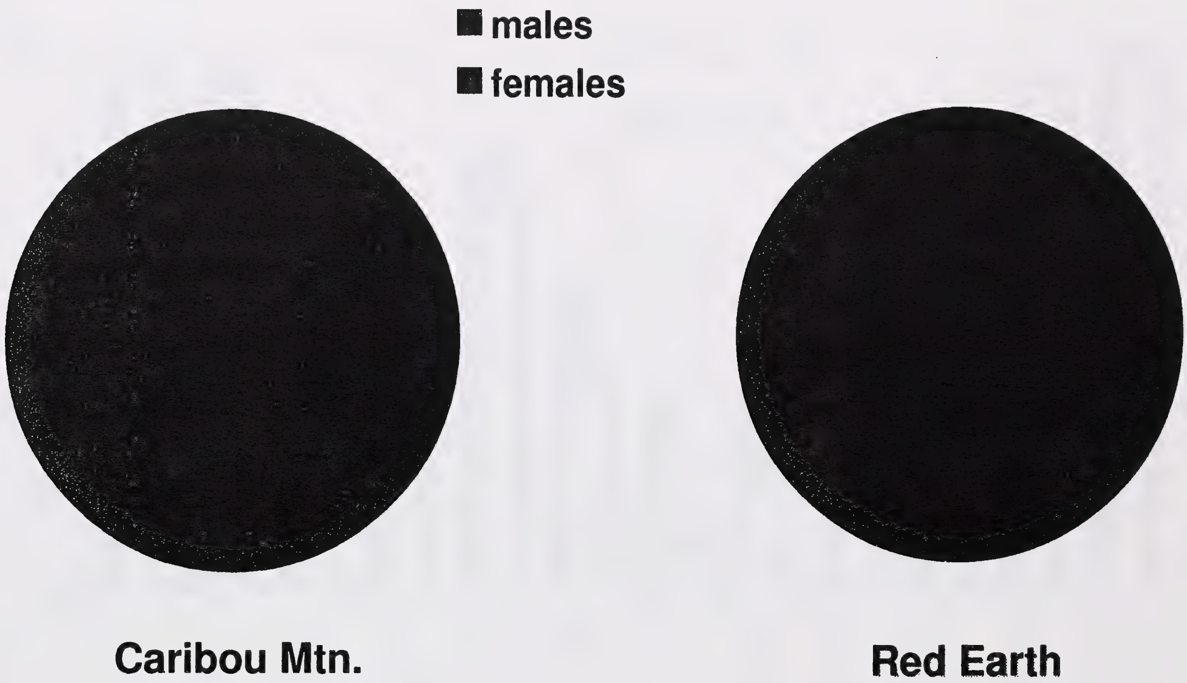

*FIGURE 2*

**NOVEMBER 1997**

# VISUAL SIGHTINGS

## Jan 95 - Jun 97

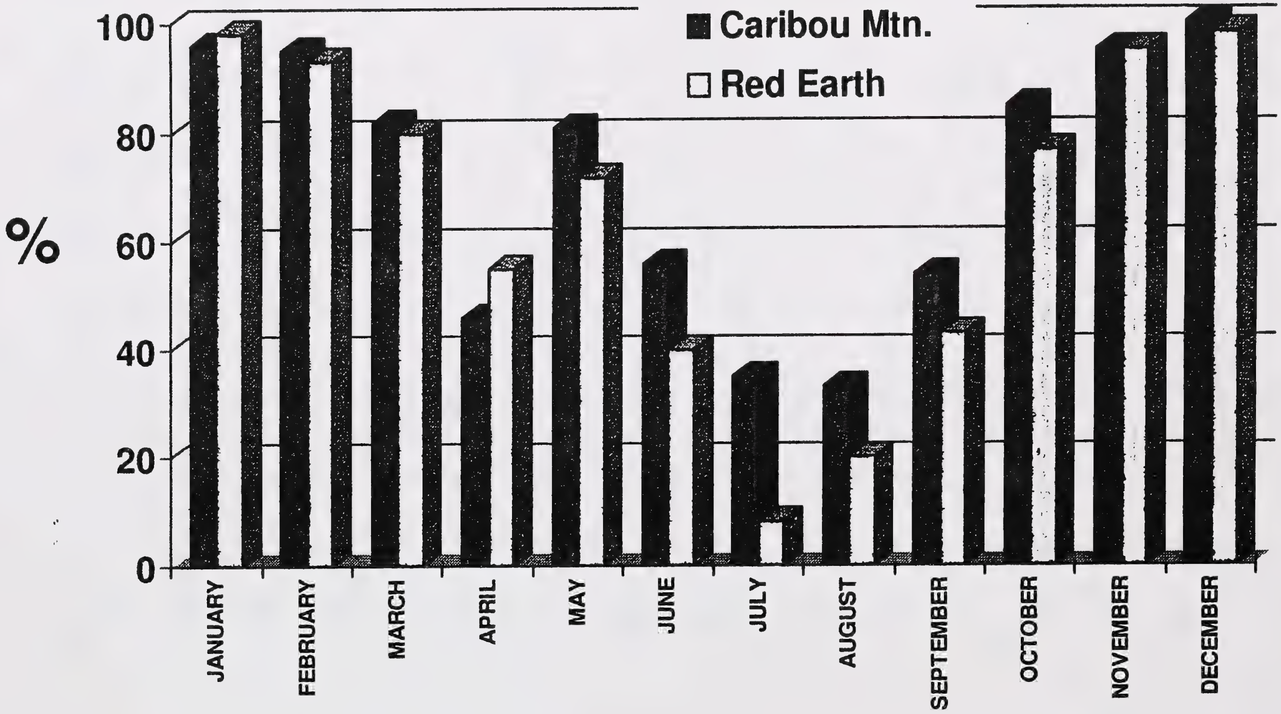

*FIGURE 3*

**SEPTEMBER 1997**

# Average Group Size 1995 - 1997
# Caribou Mountains and Red Earth

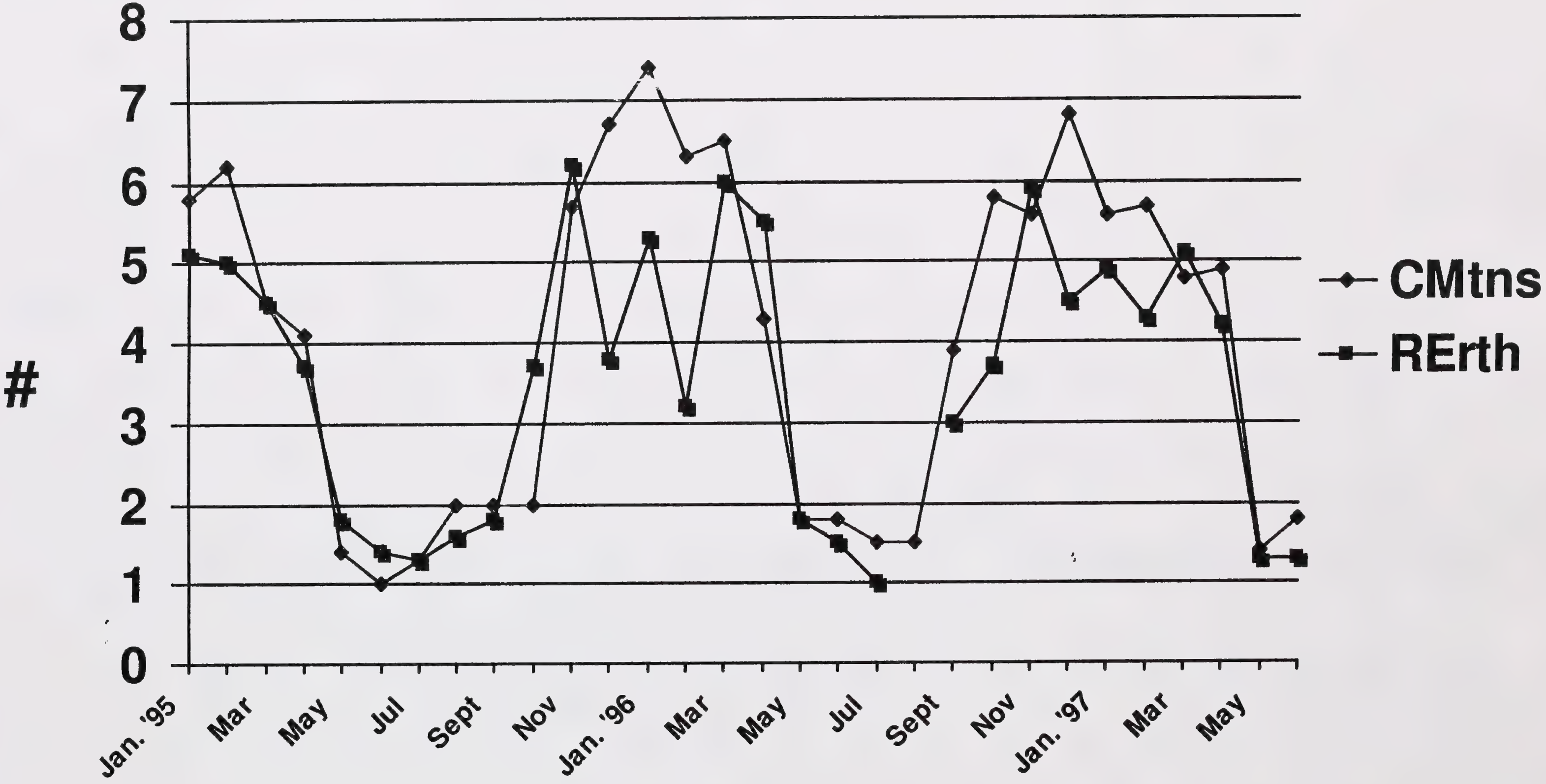

*FIGURE4*

**SEPTEMBER 1997**

# DAILY RATE OF MOVEMENT
## Red Earth (females)

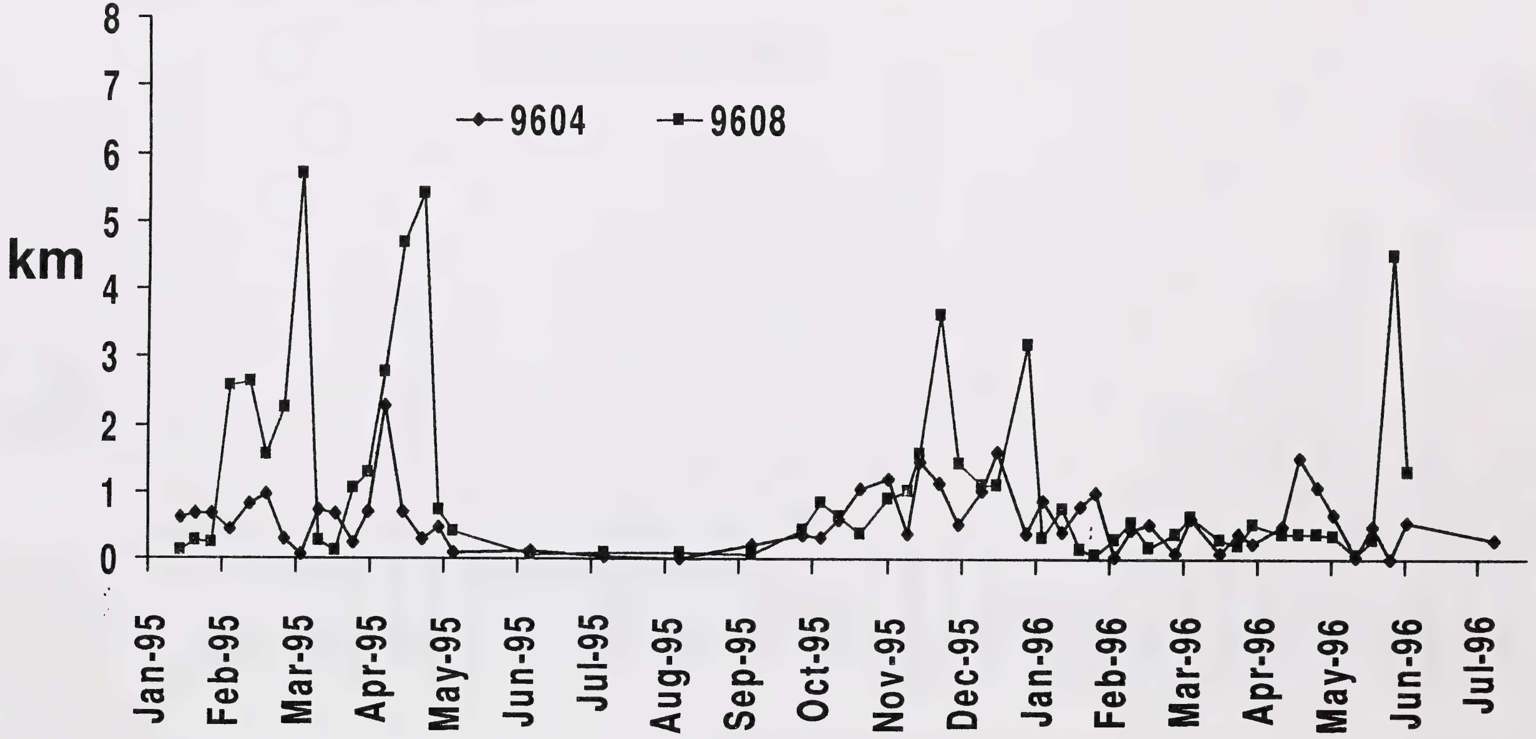

*FIGURE 5*

**SEPTEMBER 1997**

# DAILY RATE OF MOVEMENT
## Caribou Mtn. (female)

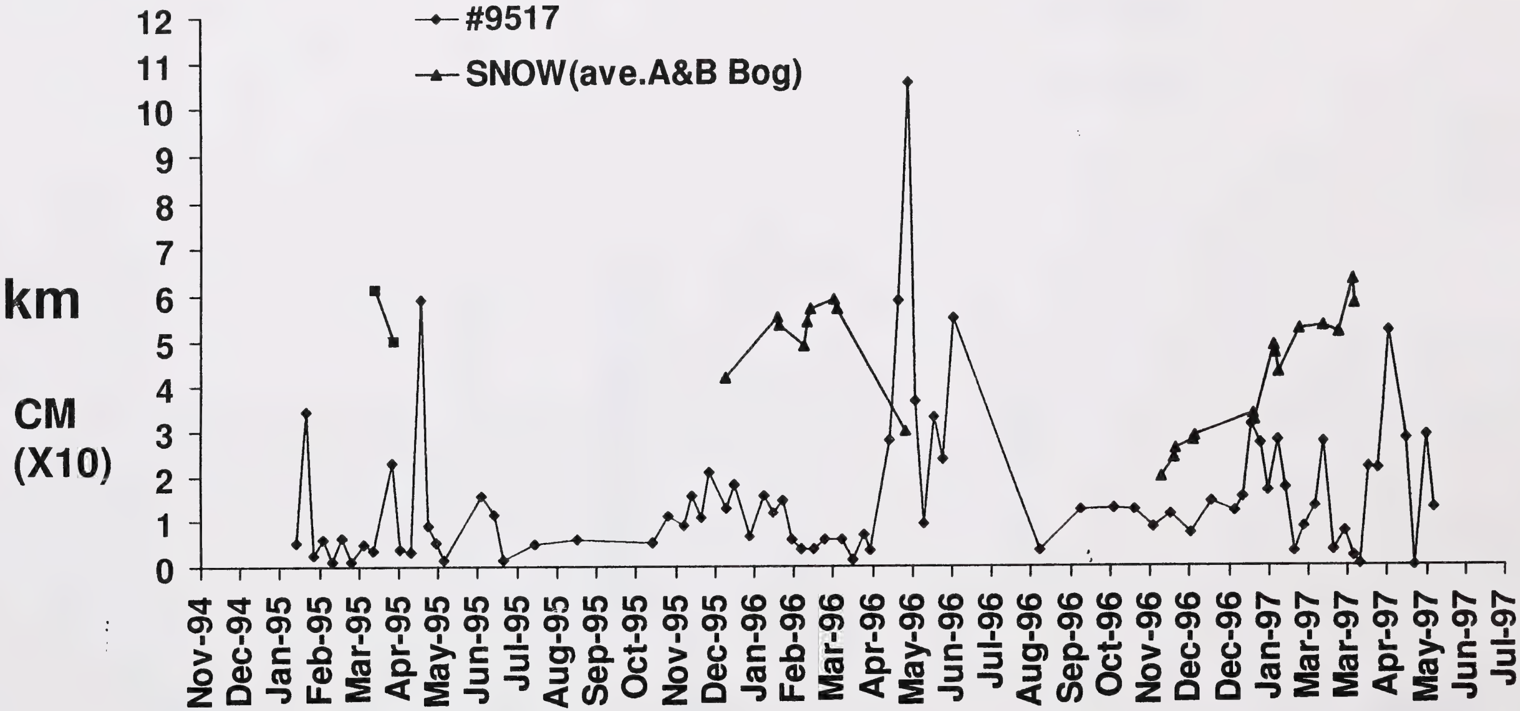

*FIGURE 6*

**NOVEMBER 1997**

# CALVING DATES 1995-1997
## Caribou Mtn.

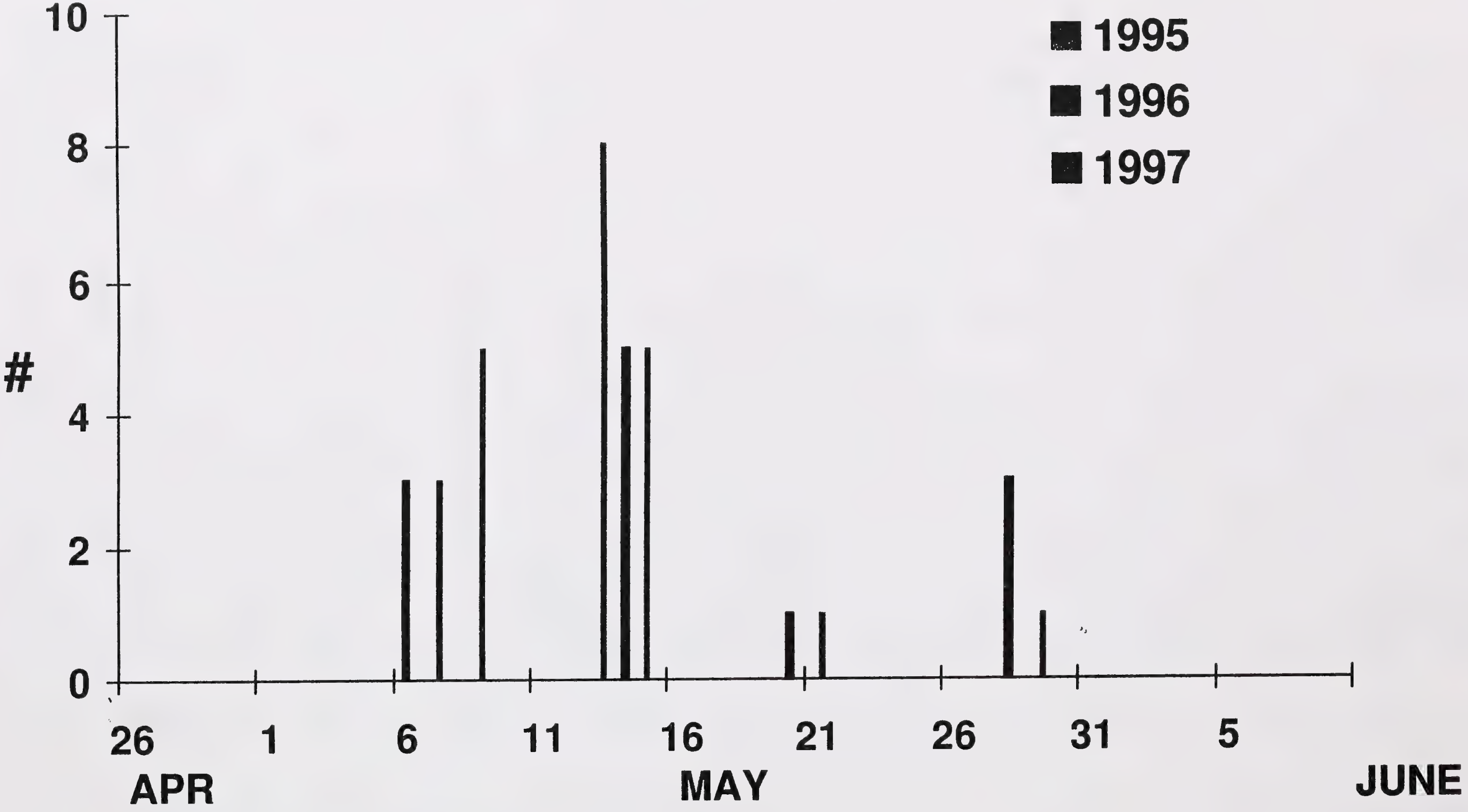

*FIGURE 7*

NOVEMBER 1997

# CALVING DATES 1995-1997

## Red Earth

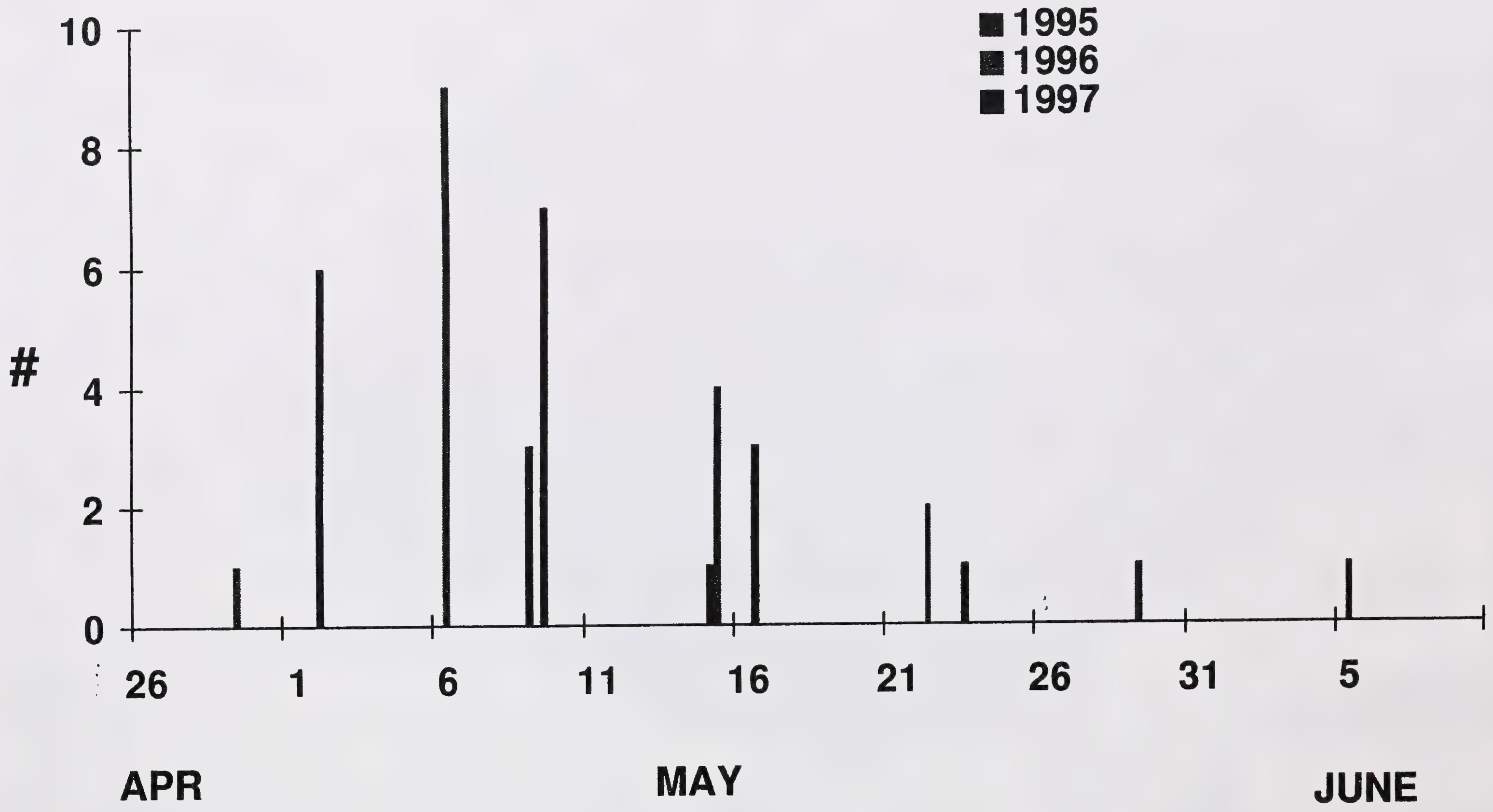

*FIGURE 8*

NOVEMBER 1997

# CALVING LOCATIONS CARIBOU MTN. 1995 - 1997

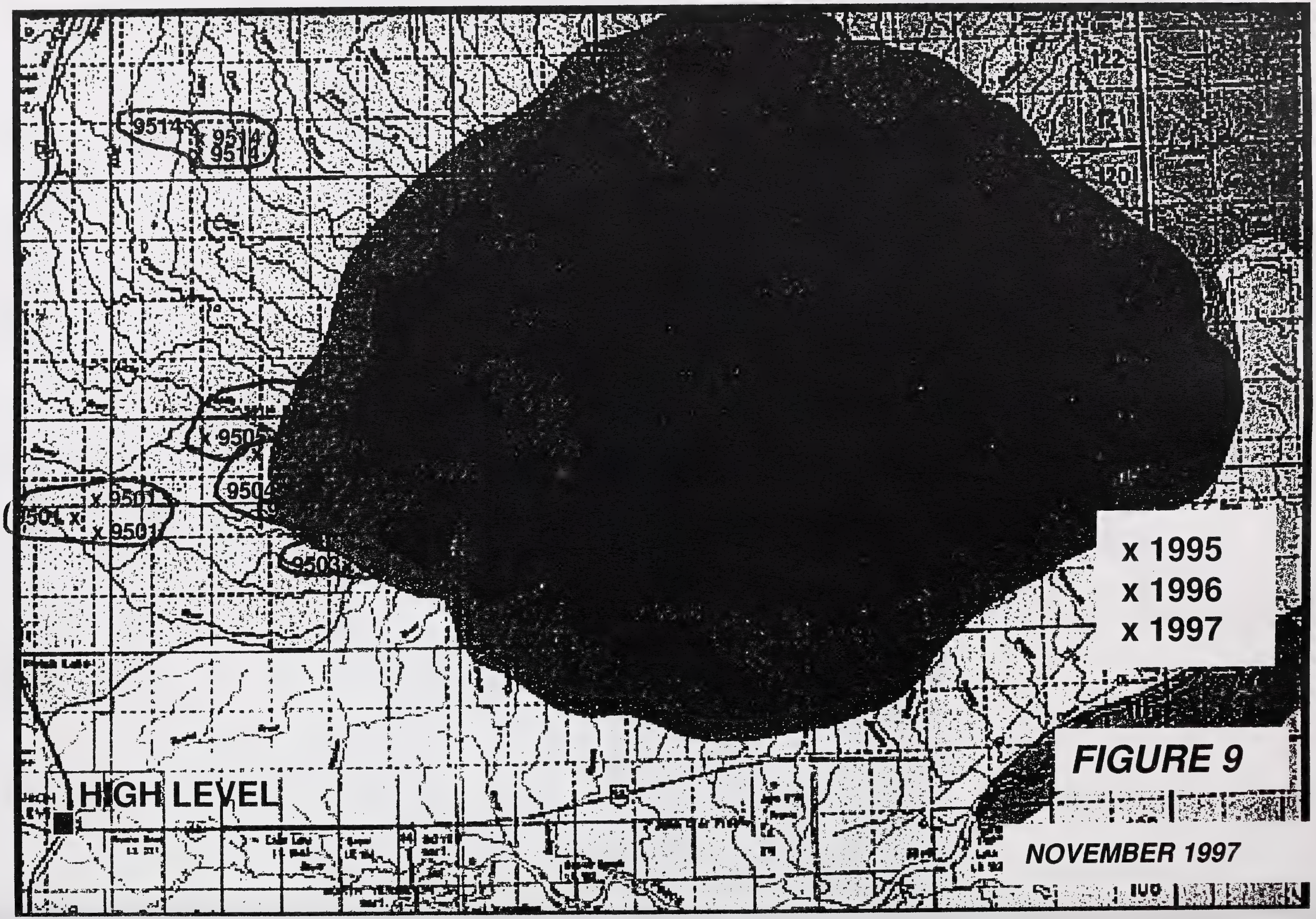
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FIGURE 9

NOVEMBER 1997

# CALVING LOCATIONS RED EARTH 1995 - 1997

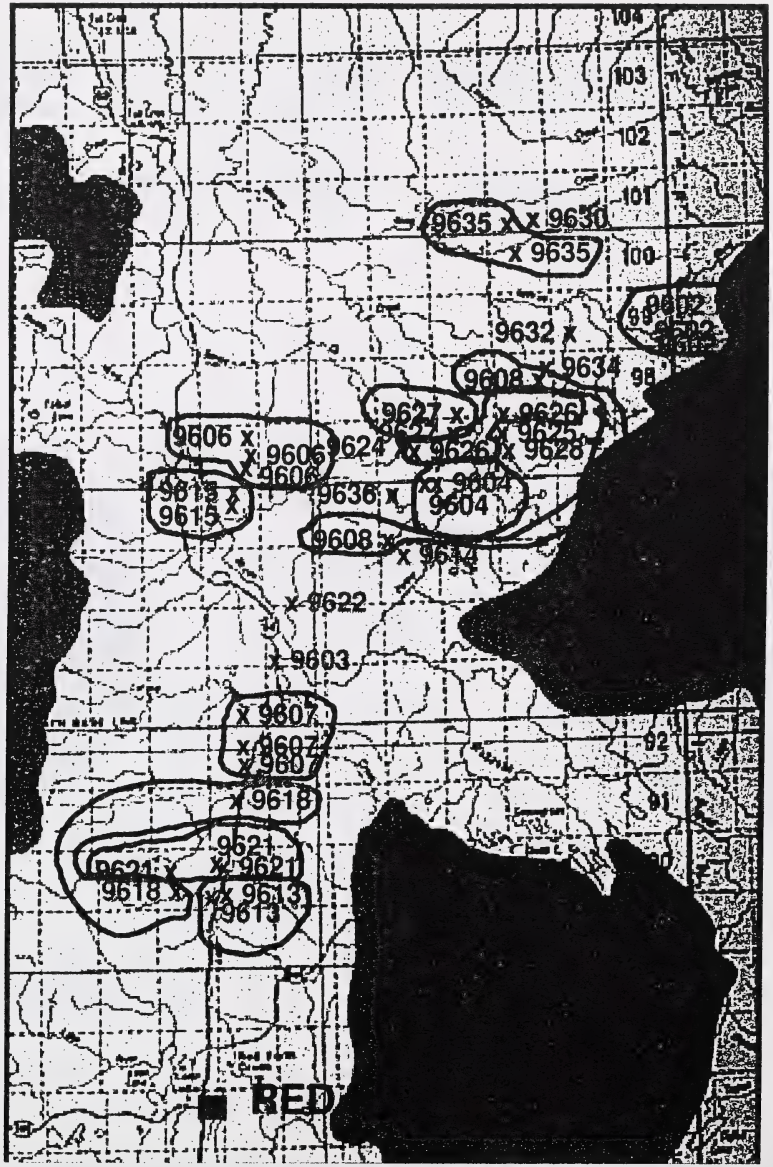


*FIGURE 10*

*NOVEMBER 1997*

# CAUSES OF MORTALITY

## January 1995 - August 1997

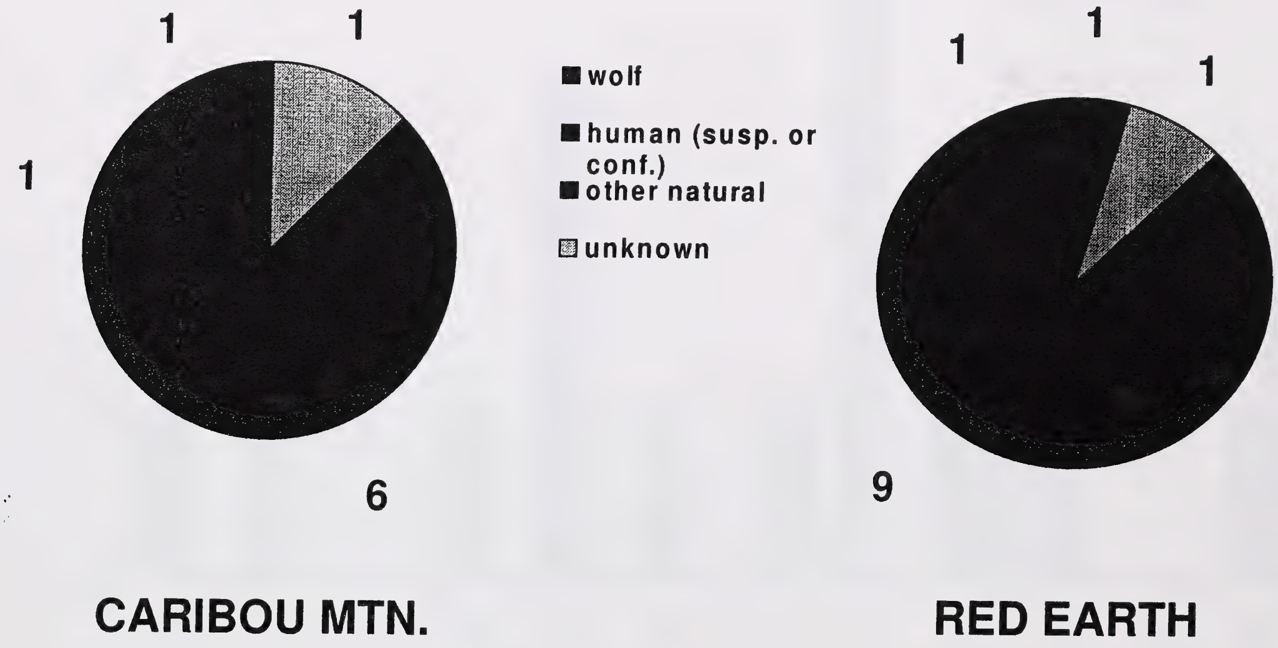


*FIGURE 11*
**NOVEMBER 1997**

# WOLF PREDATION
## Caribou Mtn., Red Earth, and Pedigree

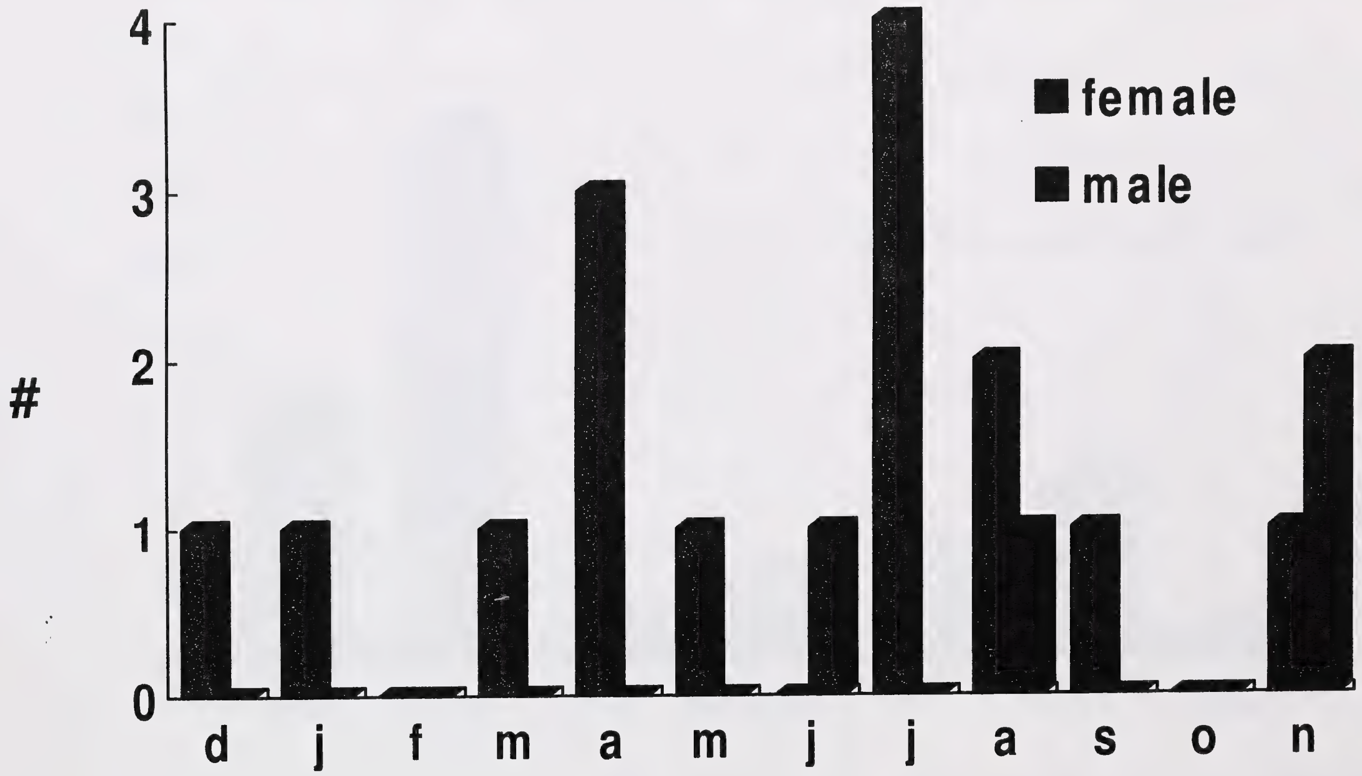


*FIGURE 12*

**NOVEMBER 1997**

# CALVING HABITAT
## Caribou Mtns and Red Earth

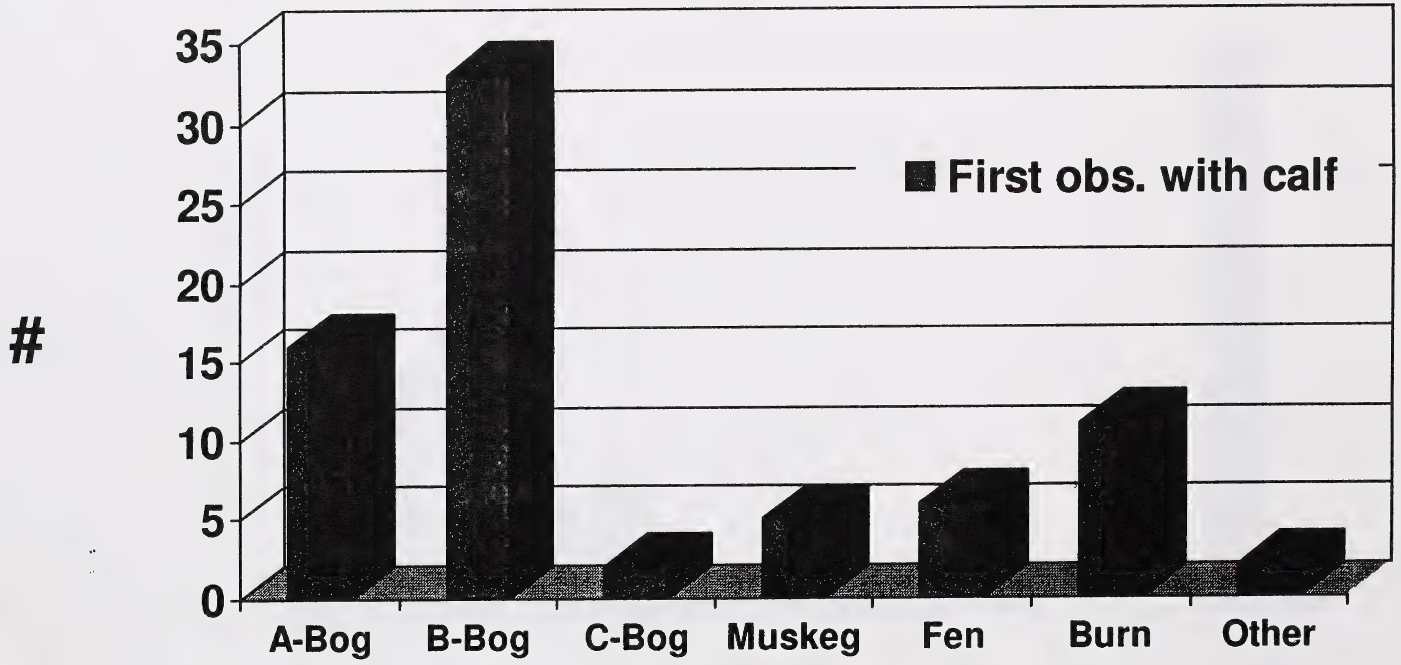


*FIGURE 13*

**NOVEMBER 1997**

# BACKTRACKING - TRAVEL
## Caribou Mtn. (145.5 km)
## Winters 1995/96 & 1996/97

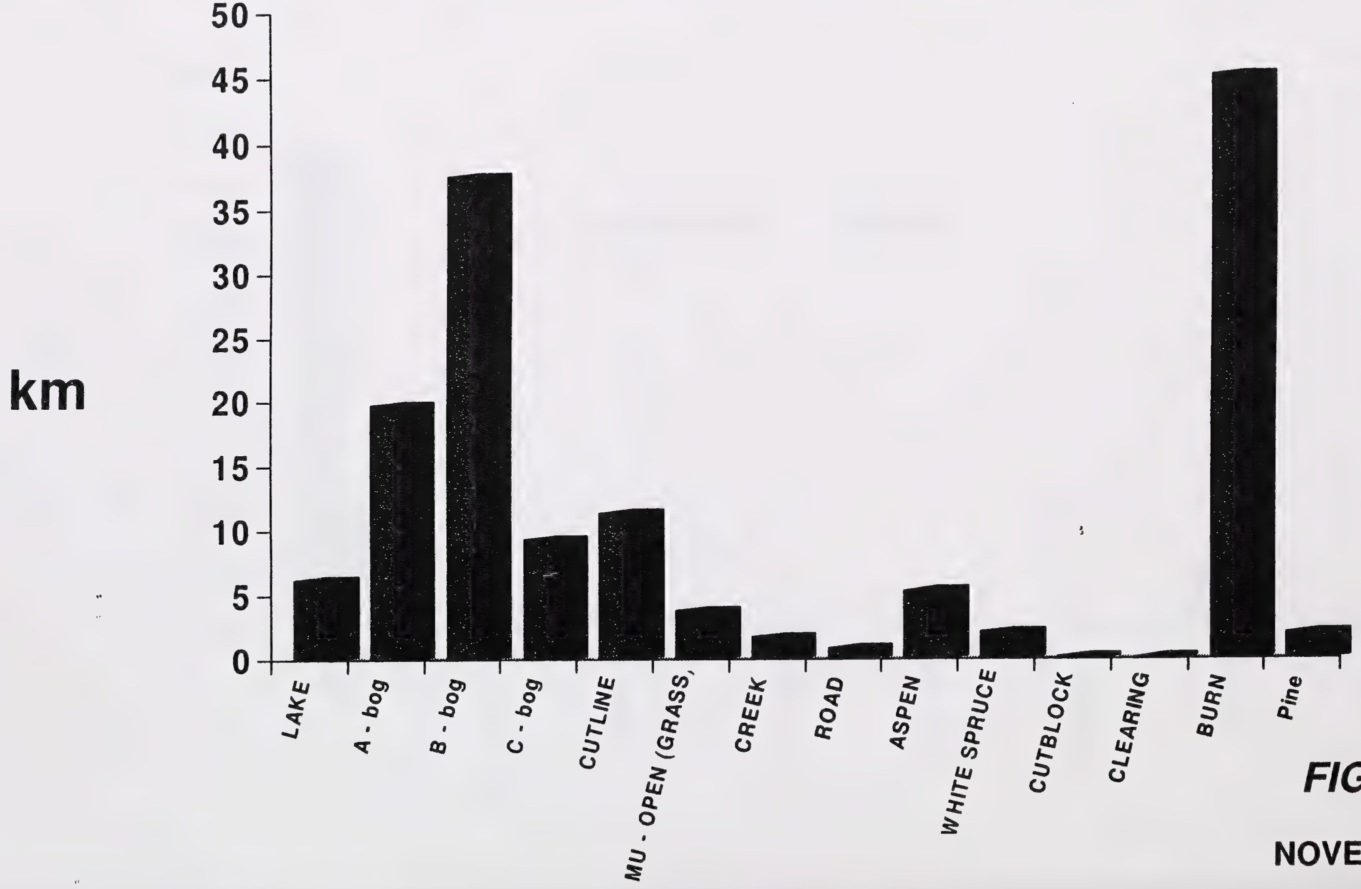


*FIGURE 14*

**NOVEMBER 1997**

# CRATER AND BED COMPLEXES
## Caribou Mtn. - Winter 1995-1997

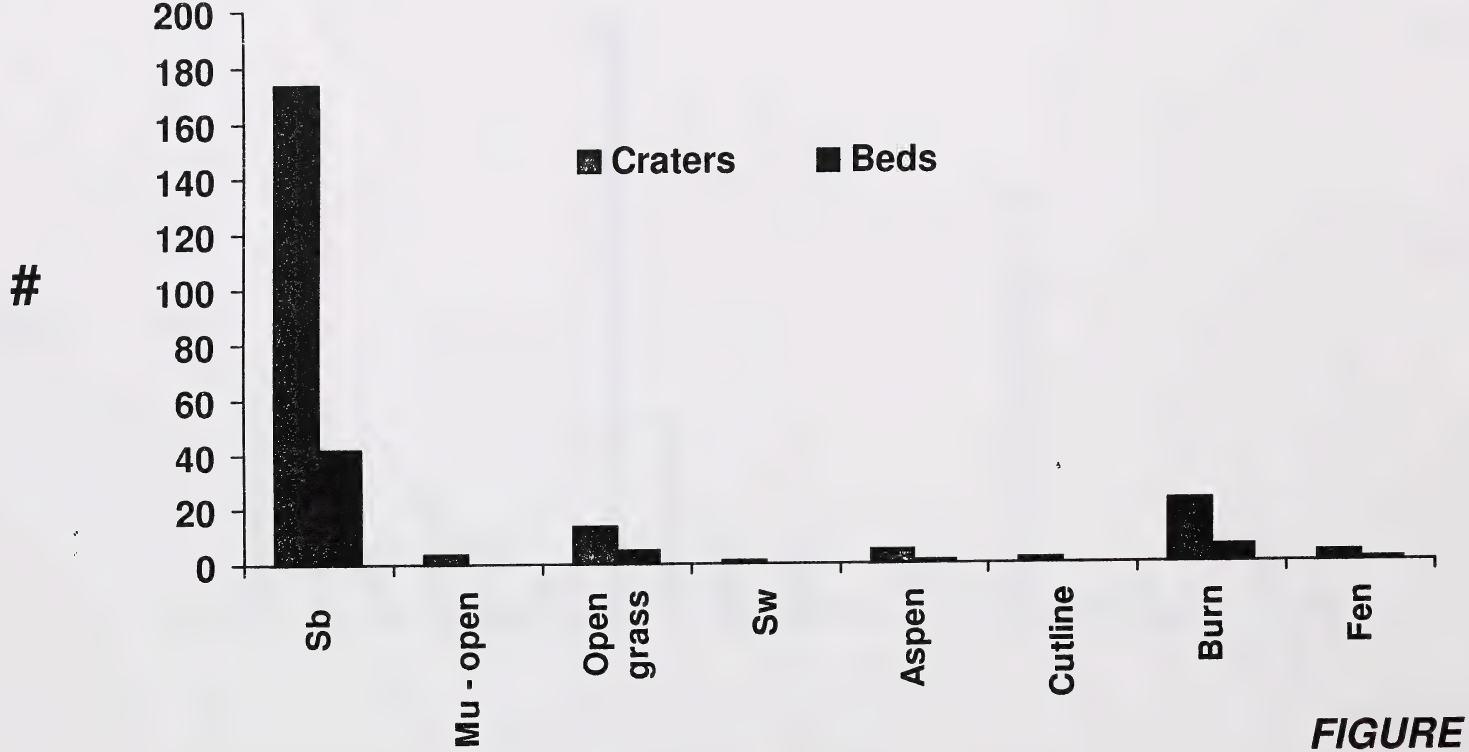


*FIGURE 15*

*NOVEMBER 1997*

# BACKTRACKING - TRAVEL
## Red Earth (122.5 km)
## Winters 1995/96 & 1996/97

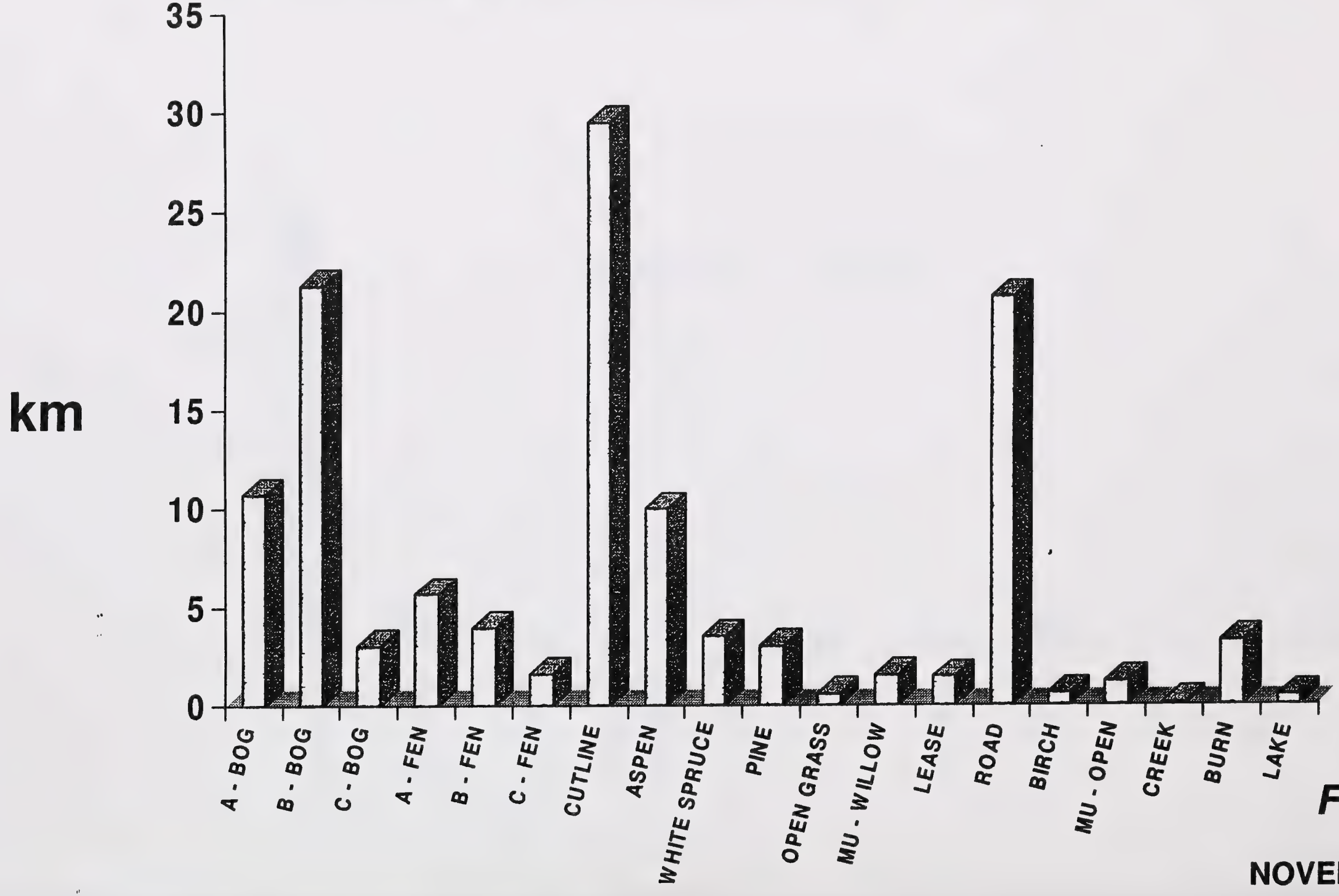


*FIGURE 16*

**NOVEMBER 1997**

# CRATER AND BED COMPLEXES
# Red Earth - Winter 1995-1997

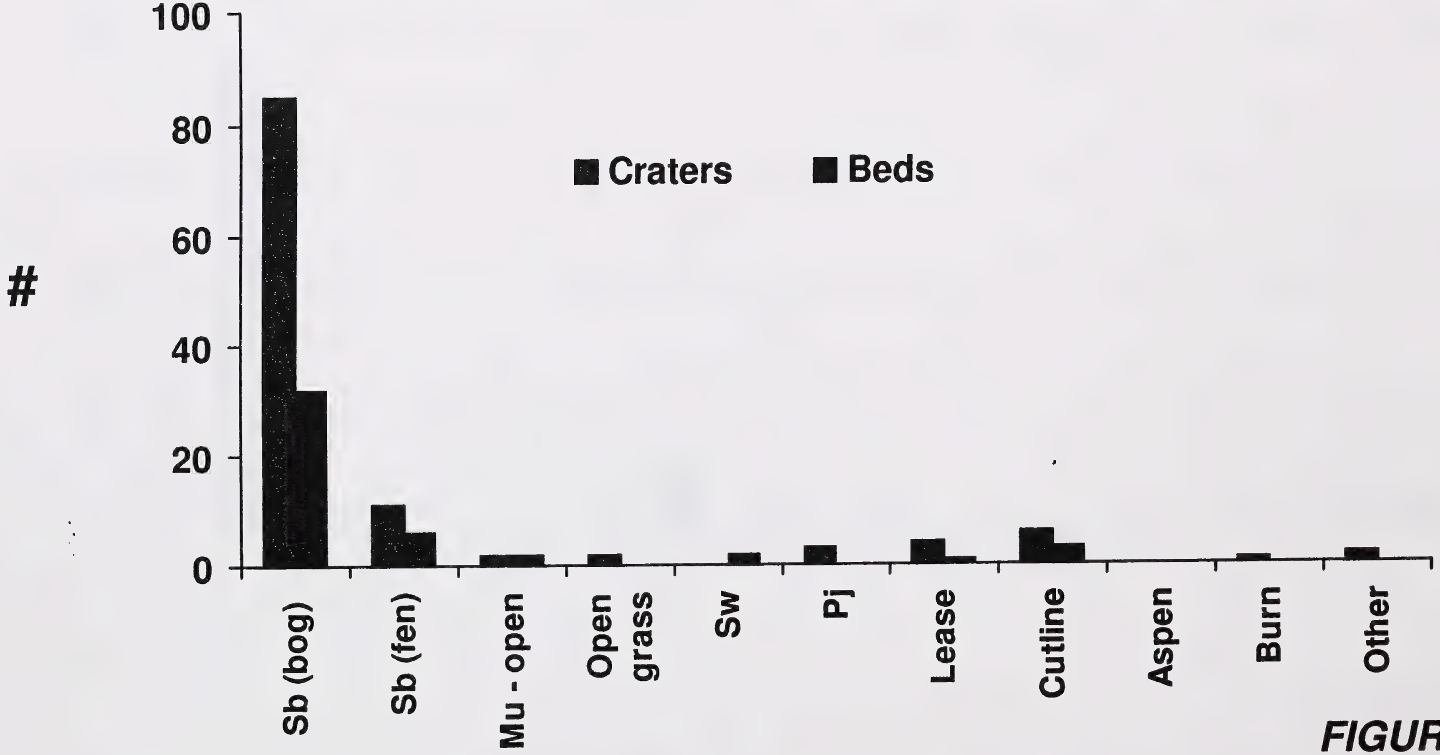


*FIGURE 17*

**NOVEMBER 1997**

# PELLET ANALYSIS - FEB-MAY 95
## Caribou Mtn. - plateau

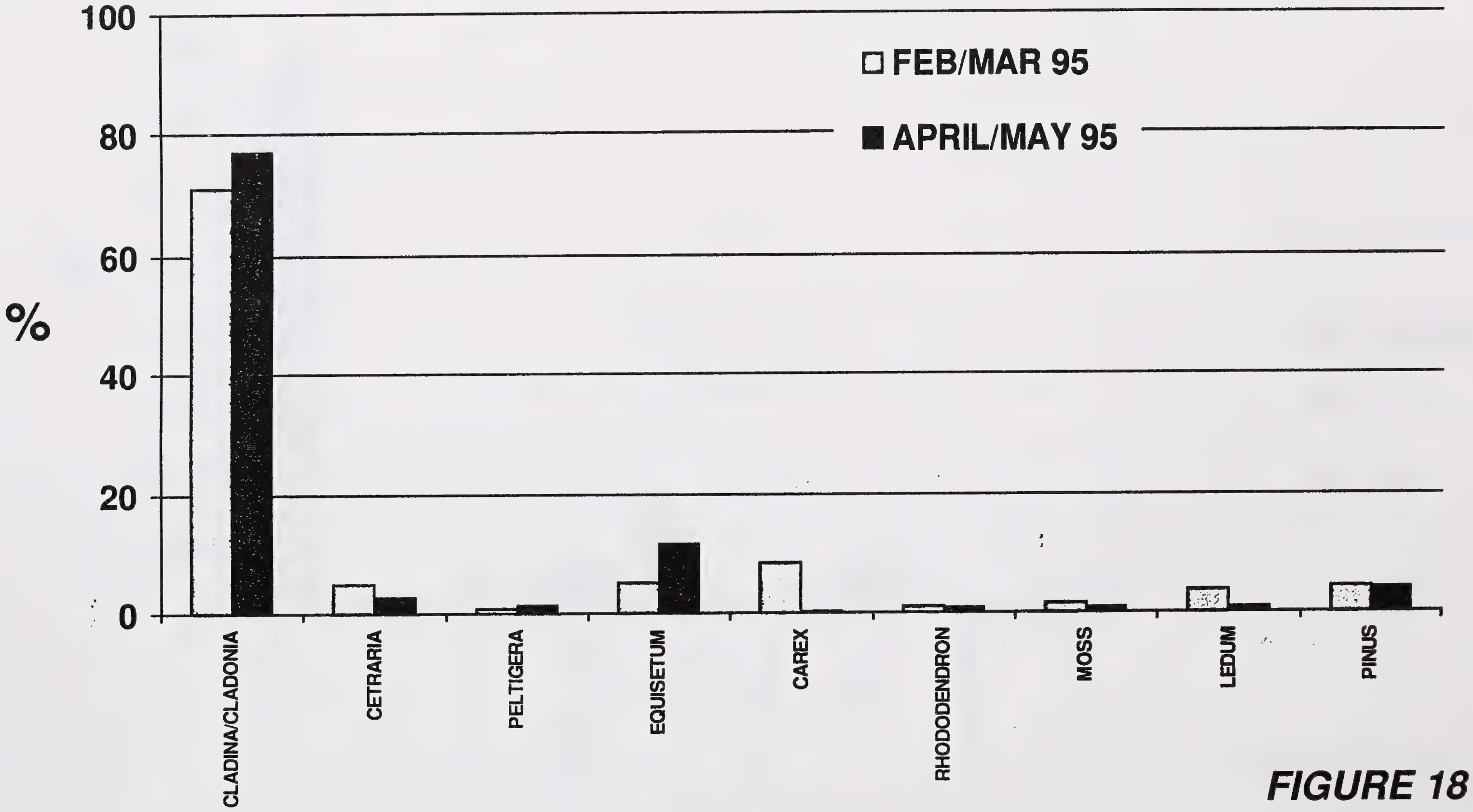


*FIGURE 18*

**NOVEMBER 1997**

# PELLET ANALYSIS - NOV 95/APR 96
## Caribou Mountains - Plateau

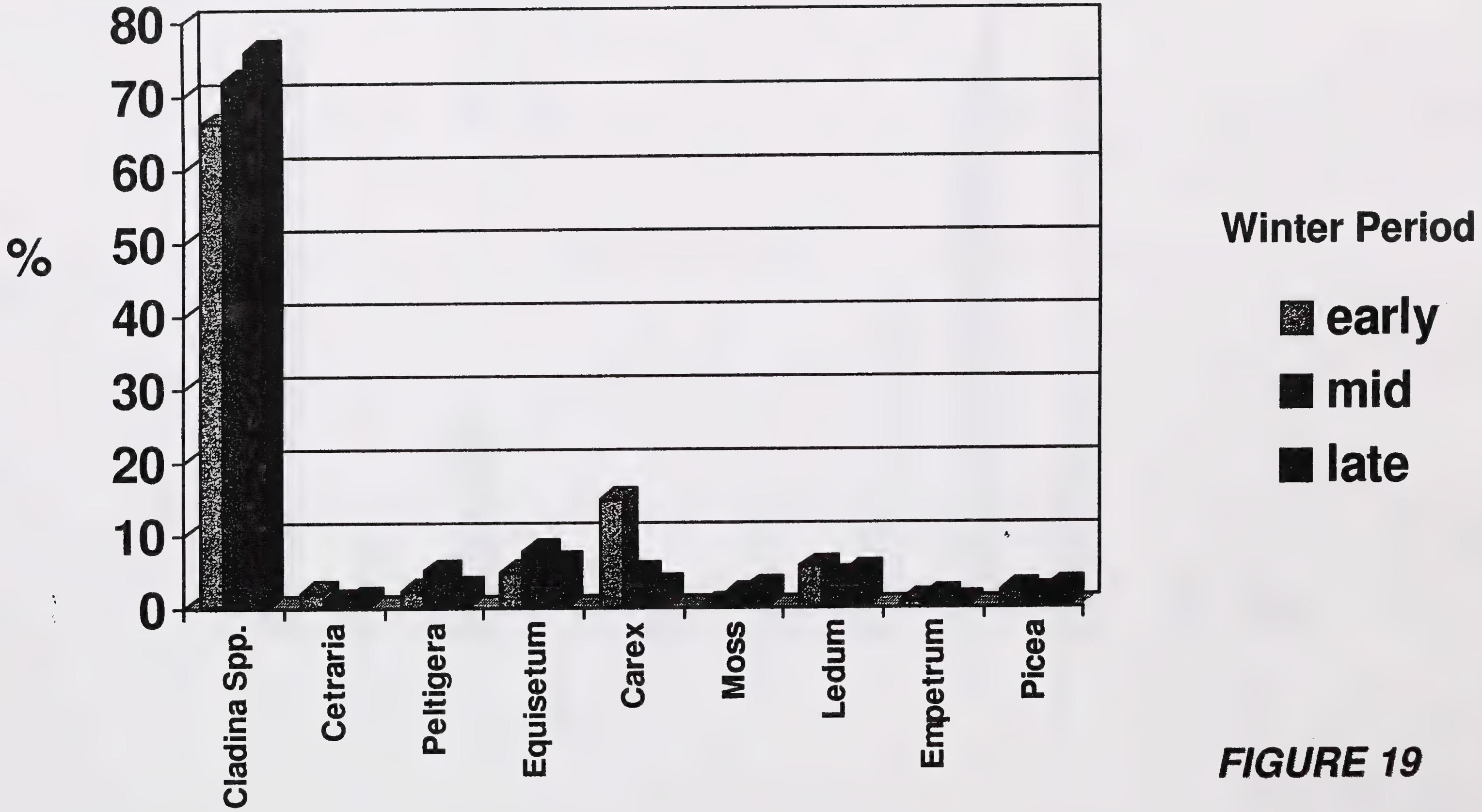


*FIGURE 19*

NOVEMBER 1997

# SPECIES IN CRATERS
## Caribou Mtn. - plateau   Winter 1995-96

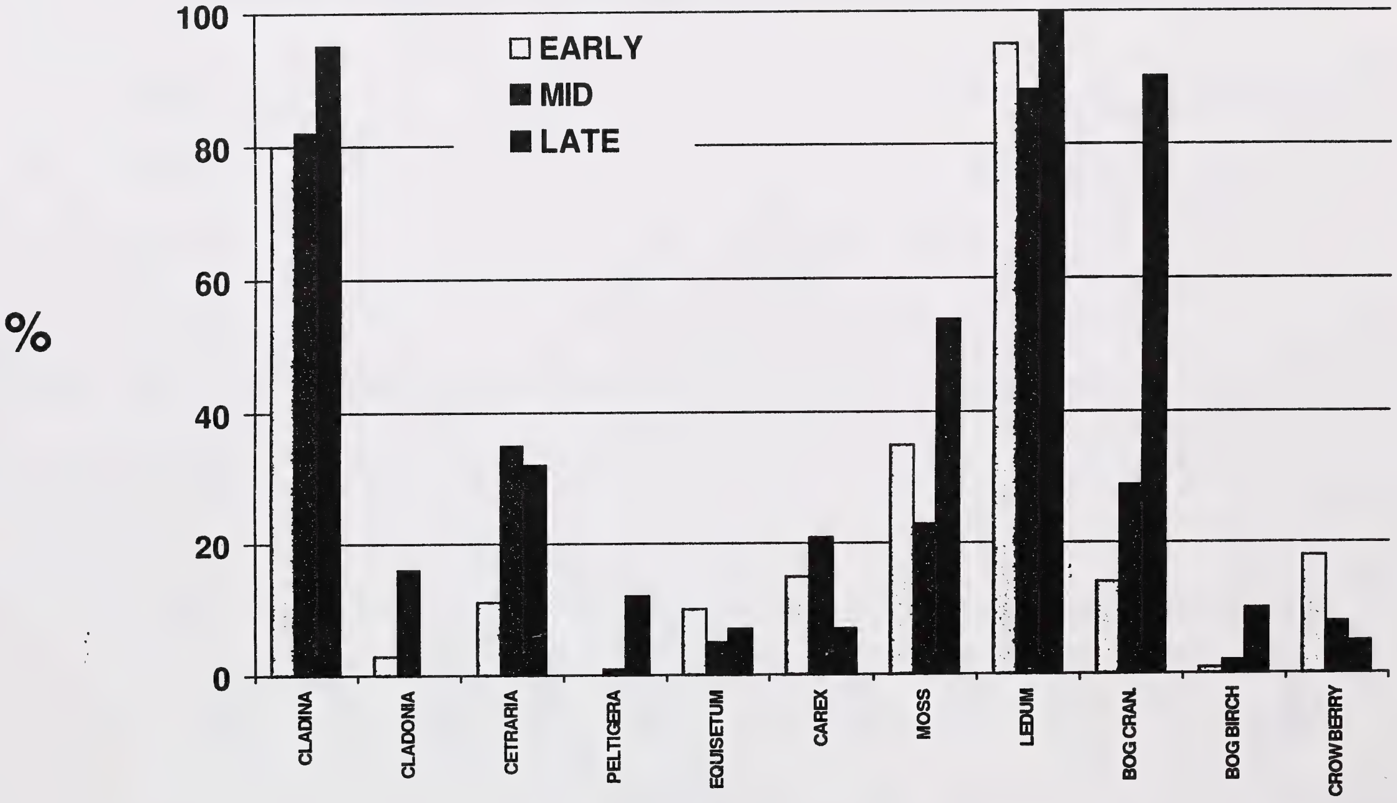


*FIGURE 20*
**NOVEMBER 1997**

# HISTORIC WEATHER DATA
## Caribou Mtn.
## average winter precipitation (mm)

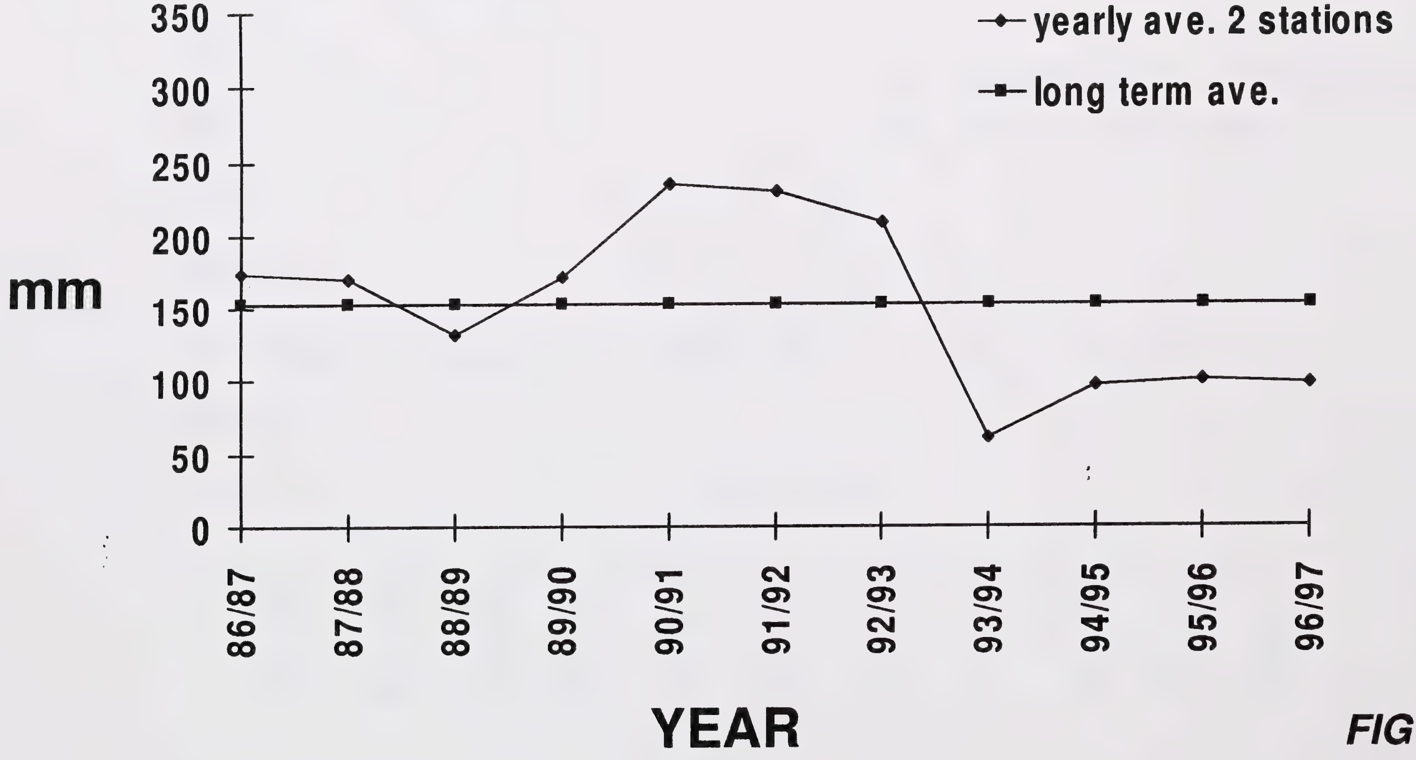


*FIGURE 21*

**NOVEMBER 1997**

# HISTORIC WEATHER DATA

## Red Earth

## average winter precipitation (mm)

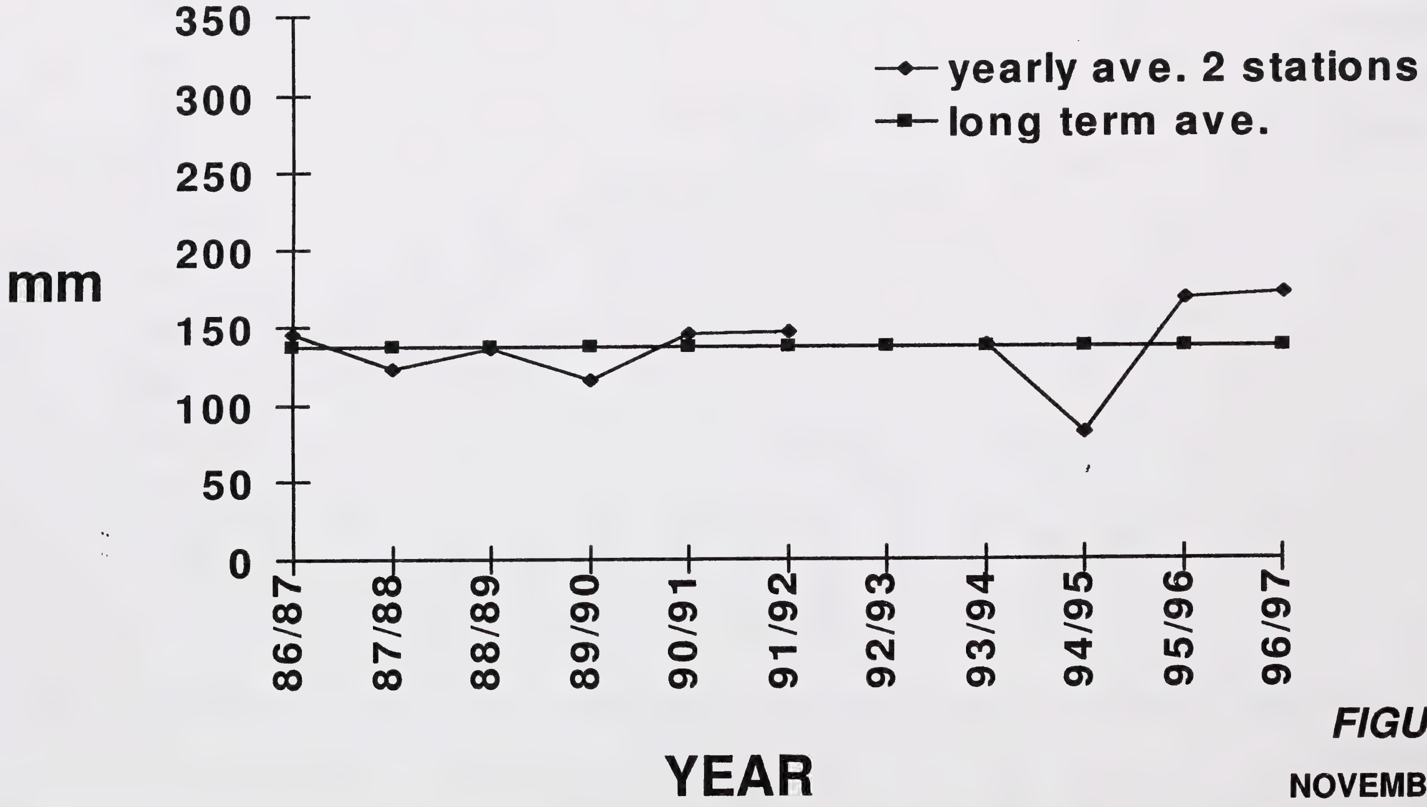


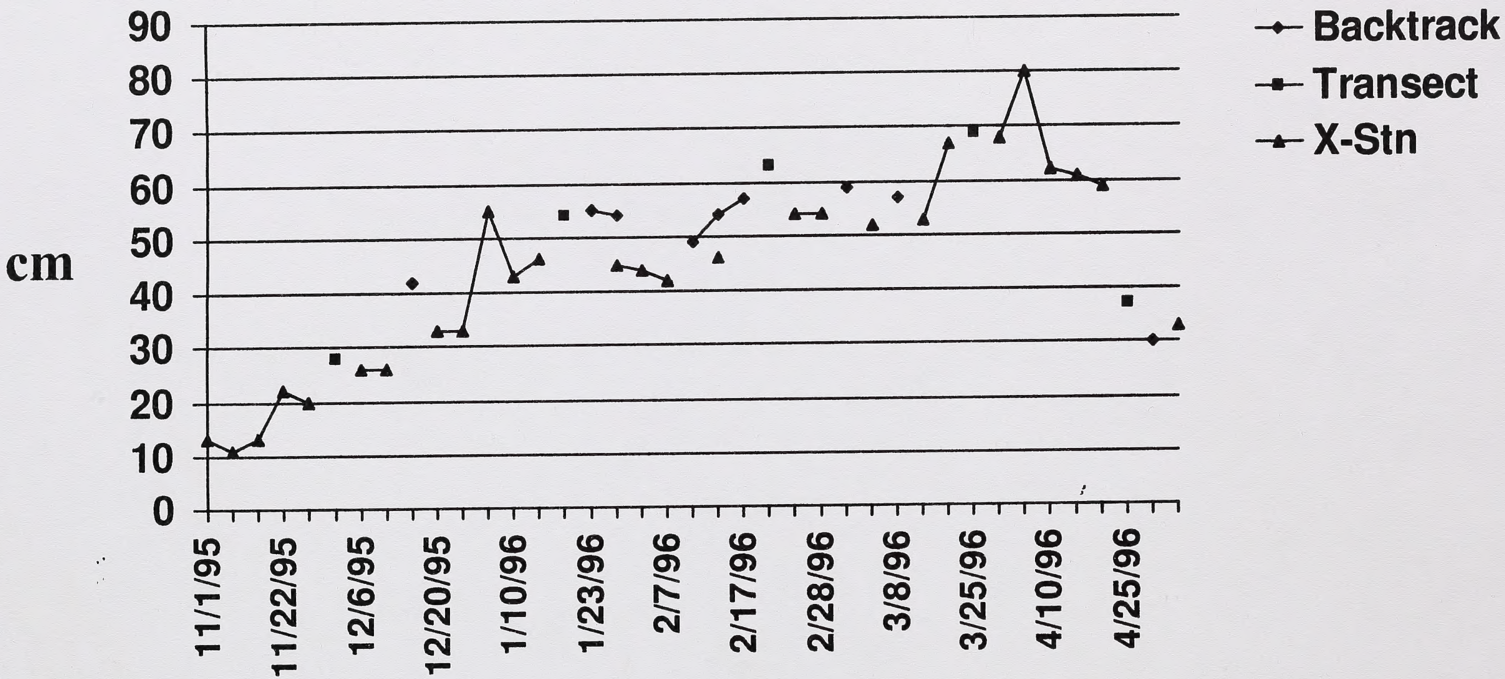
*FIGURE 22*

NOVEMBER 1997

# Caribou Mountain Snow Data

## Backtracking/Transects/Weather Station

## Cmtns - Top Winter 1995 - '96



Note: Snow depths from Backtracking and transects are the average for the day from A and B-density Bogs.

*FIGURE 23*

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